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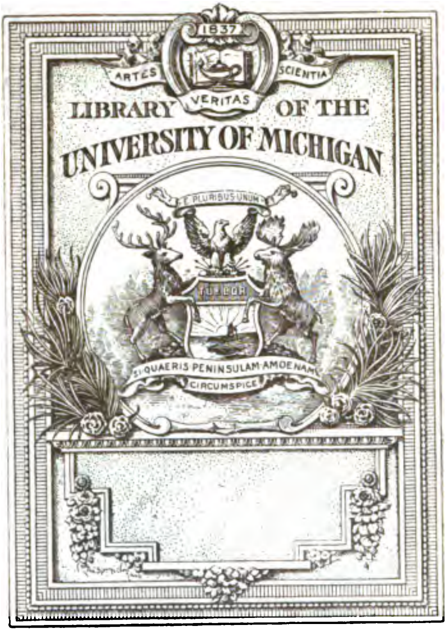

THE GIFT OF
Dr. W. Lombard

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ON THE

IMPROVEMENT OF SOCIETY

BY THE

DIFFUSION OF KNOWLEDGE:

OR,

AN ILLUSTRATION OF THE ADVANTAGES WHICH WOULD RESULT
FROM A MORE GENERAL DISSEMINATION OF RATIONAL
AND SCIENTIFIC INFORMATION AMONG ALL RANKS.

BY THOMAS DICK, LL.D.

Author of "The Christian Philosopher," "The Philosophy of Religion," "The Philosophy of a Future State," &c.

Knowledge is Power.—*Lord Bacon.*

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A

PREFACE.

THE plan and outlines of the following work were sketched, and a considerable portion of it composed, about eighteen years ago. It was advertised, as preparing for the press in 1823, when the author published the first edition of "The Christian Philosopher;" but various other engagements prevented its appearance at that period. The introduction and the first two Sections were published in a respectable Quarterly Journal, in the year 1816; but they are now considerably modified and enlarged. This circumstance will account for the date of some of the illustrative facts to which reference is made in the first part of the volume and in several portions of the Appendix.

Had the present work been published at any of the periods now referred to, the subject it discusses, and some of the illustrations, would have presented a more novel aspect than they can lay claim to at the present time, when the diffusion of knowledge has become an object of general attention. The author, however, is not aware that any work embracing so full an illustration of the same topics has

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yet made its appearance; and is therefore disposed to indulge the hope, that, in conjunction with the present movements of society, it may, in some degree, tend to stimulate those exertions which are now making for the melioration and mental improvement of mankind. Independently of the general bearing of the facts and illustrations on the several topics they are intended to elucidate, the author trusts, that not a few fragments of useful knowledge will be found incorporated in the following pages, calculated to entertain and instruct the general reader.

In the numerous illustrations brought forward in this volume, it was found impossible altogether to avoid a recurrence to certain facts which the author had partially adverted to in some of his former publications,—without interrupting the train of thought, and rendering his illustrations partial and incomplete. But where the same facts are introduced, they are generally brought forward to elucidate a different topic. Any statements or descriptions of this kind, however, which may have the appearance of repetition, could all be comprised within the compass of three or four pages.

The general subject of the present work will be prosecuted in another volume, to be entitled "The Mental Illumination of Mankind; or an Inquiry into the Means by which a general Diffusion of Knowledge may be promoted." This work will embrace,—along with a great variety of other topics,—an examination of the present system of education, showing its futility and inefficiency, and illustrating the principles and details of an efficient intellectual system, capable of universal application; together with a variety of suggestions in relation to the physical, moral, and intellectual improvement of society.

To his numerous correspondents who have been inquiring after the work "*The Scenery of the Heavens displayed*, with the view of illustrating the doctrine of a *Plurality of Worlds*," which was announced at page 285, of the "Philosophy of a Future State,"—the author begs respectfully to state, that, if health permit, he intends to proceed, without delay, to the completion of that work, as soon as the volume announced above is ready for the press. It will form a volume of considerable size, and will be illustrated with a great number of engravings, many of which will be original.

Broughty Ferry, near Dundee,
18*th April*, 1833.

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ON THE

GENERAL DIFFUSION OF KNOWLEDGE.

INTRODUCTION.

WHEN we take a retrospective view of the state of mankind during the ages that are past, it presents, on the whole, a melancholy scene of intellectual darkness. Although in every age men have possessed all the mental faculties they now or ever will enjoy, yet those noble powers seem either to have lain in a great measure dormant, or, when roused into action, to have been employed chiefly in malignant and destructive operations. Hence the events which the page of history records chiefly present to our view the most revolting scenes of war, rapine, and devastation, as if the earth had been created merely to serve as a theatre for mischief, and its inhabitants for the purpose of dealing destruction and misery to all around them. Such, however, are the natural consequences of the reign of *Ignorance* over the human mind: for the active powers of man necessarily follow the dictates of his understanding, and when the intellectual faculties are not directed to the pursuit and the contemplation of noble and benevolent objects, they will most frequently be employed in devising and executing schemes subversive of human happiness and improvement.

Amid the darkness which in ancient times so long overspread the world, some rays of intellectual light appeared in Palestine, in Egypt, and in the Greek and Roman empires; but its influence on the nations around was extremely feeble, and, like a few tapers in a dark night, served little more than to render the surrounding darkness visible. The light of science which then shone was, however, doomed to be speedily extinguished. About the fifth century of the

Christian era, numerous hordes of barbarians from the northern and the eastern parts of Europe, and the north-western parts of Asia, overran the western part of the Roman empire, at that time the principal seat of knowledge; and, in their progress, overturned and almost annihilated every monument of science and art which then existed. Wherever they marched, their route was marked with devastation and with blood. They made no distinction between what was sacred and what was profane—what was barbarous and what was refined. Amid the din of war, the burning of cities, the desolation of provinces, the convulsion of nations, the ruin of empires, and the slaughter of millions, the voice of reason and of religion was scarcely heard: science was abandoned; useful knowledge was set at naught; every benevolent feeling and every moral principle were trampled under foot. The earth seemed little else than one great field of battle; and its inhabitants, instead of cultivating the peaceful arts and sciences, and walking hand in hand to a blessed immortality, assumed the character of demons, and gave vent to the most fiend-like and ferocious passions, till they appeared almost on the brink of total extermination.

For nearly the space of a thousand years posterior to that period, and prior to the Reformation, a long night of ignorance overspread the nations of Europe, and the adjacent regions of Asia, during which, the progress of literature and science, of religion and morality, seems to have been almost at a stand; scarcely a vestige remaining of the efforts of the human mind, during all that period, worthy of the attention or the imitation of succeeding ages. The debasing superstitions of the Romish church, the hoarding of relics, the erection of monasteries and nunneries, the pilgrimages to the tombs of martyrs and other holy places, the mummeries which were introduced into the services of religion, the wild and romantic expeditions of crusaders, the tyranny and ambition of popes and princes, and the wars and insurrections to which they gave rise, usurped the place of every rational pursuit, and completely enslaved the minds of men. So great was the ignorance which then prevailed, that persons of the most distinguished rank could neither read nor write. Even many of the clergy did not understand the breviary, or book of common prayer, which they were daily accustomed to recite, and some of them could scarcely read it.* The records of past transactions were in a great measure lost, and legendary tales and fabulous histories, to celebrate exploits which were never performed, were substituted in place of the authenticated history of mankind. The learning which then prevailed under the name of philosophy and scholastic theology consisted chiefly in vain disquisitions and reasonings about abstract truths, and incomprehensible mysteries, and in attempts to decide questions and points of theology, which lie beyond the reach of the human mind, and which its limited faculties are unable to resolve. Sophisms, falsehoods, and bold asseverations were held forth as demonstrations; a pompous display of *words* was substituted in the place of *things*; eloquence consisted in vague and futile declamations; and true philosophy was lost amid the mazes of wild and extravagant theories and metaphysical subtleties. The sciences, such as they were, were all taught in the Latin tongue, and all books in relation to them were written in that language; the knowledge of them was therefore necessarily confined to the circle of the learned, and it would have been considered as a degradation of the subject, to have treated of it in any of the modern languages which then prevailed. The gates of the temple of knowledge were *consequently* shut against the great body of the people, and it was never once surmised that they had *any right* to explore its treasures. "During this period," says Dr. Robertson, "the human mind, neglected, uncultivated, and depressed, continued in the most profound ignorance. Europe, during four centuries, produced few authors who merit to be read, either on account of the elegance of their composition, or the justness and novelty of their sentiments. There are few inventions, useful or ornamental to society, of which that long period can boast." And, if those of the highest ranks, and in the most eminent stations in society, were so deficient in knowledge, the great mass of the people must have been sunk into a state of ignorance degrading to human nature.

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* As an evidence of the extreme ignorance of those times, it may be stated, that many charters granted by persons of the highest rank are preserved, from which it appears that they could not subscribe their name. It was usual for persons who could not write to make *the sign of the cross* in confirmation of a charter. Several of these remain, where kings and persons of great eminence affix *signum crucis manu propria pro ignoratione literarum:* "the sign of the cross made by our own hand on account of our ignorance of letters." From this circumstance is derived the practice of making a + when signing a deed, in the case of those who cannot subscribe their names. See Robertson's Charles V., and *Appendix*, No. I.

About the time of the revival of letters, after the dark ages of monkish superstition and ignorance, the moral and intellectual state of the inhabitants of Europe began to experience a change auspicious of better times and of a more enlightened era. The diminution of the papal power and influence, the spirit of civil and religious liberty which then burst forth, the erection of new seminaries of education, the discovery of the mariner's compass, the invention of the art of printing, the labours of Lord Bacon in pointing out the true method of philosophizing, and the subsequent discoveries of Galileo, Kepler, Boyle, and Newton in the physical sciences, gave a new and favourable impulse to the minds of men, and prepared the way for a more extensive communication of useful knowledge to persons of every rank. From this period knowledge began to be gradually diffused among most of the European nations; but its progress was slow, and its influence was chiefly confined to the higher circles of society, and to persons connected with the learned professions, till after the middle of the eighteenth century. About this time there began to issue from the press many popular works on Natural and Civil History, Geography, Astronomy, and Experimental Philosophy, divested of the pedantry of former times, and of the technicalities of science, which, along with periodical works that were then beginning to extend their influence, conveyed to the minds of the mechanic and the artisan various fragments of useful knowledge. It was not, however, till the era of the French Revolution, that the stream of knowledge began to flow with an accelerated progress, and to shed its influence more extensively on the middling and the lower orders of society. Though we cannot look back, without feelings of regret and even of horror, at the revolting scenes of anarchy and bloodshed which accompanied that political convulsion, yet amid all its evils, it was productive of many important and beneficial results. It tended to undermine that system of superstition and tyranny by which most of the European nations had been so long enslaved; it roused millions, from among the mass of the people, to assert those rights and privileges to which they are entitled as rational beings, and which had been withheld from them by the strong hand of power; it stimulated them to investigations into every department connected with the rights and the happiness of man, and it excited a spirit of inquiry into every subject of contemplation that can improve or adorn the human mind, which, we trust, will never be extinguished, till the light of useful knowledge shall extend its influence over all the inhabitants of the earth.

Striking, however, as the contrast is, between the state of knowledge in the present and in former ages, much still remains to be accomplished, till the great body of mankind be stimulated to the prosecution of intellectual acquirements. Though a considerable portion of rational information has of late years been disseminated among a variety of individuals in different classes of society, yet, among the great majority of the population in every country, a degree of ignorance still prevails, degrading to the rank of intellectual natures. With respect to the great mass of the inhabitants of the world, it may still be said with propriety, "that darkness covers the earth, and gross darkness the people." The greater part of the continent of America, the extensive plains of Africa, the vast regions of Siberia, Tartary, Tibet, and the Turkish empire—the immense territories of New-Holland, Sumatra, Borneo, and the Burman empire, the numerous islands which are scattered throughout the Indian and the Pacific oceans, with many other extensive regions inhabited by human beings—still lie within the confines of mental darkness. On the numerous tribes which people those immense regions of our globe, neither the light of science nor of revelation has yet shed its benign influence; and their minds, debased by superstition, idolatry, and every malignant passion, and enslaved by the cunning artifices of priests, and the tyranny of cruel despots, present a picture of human nature in its lowest stage of degradation.—Even in Europe, where the light of science has chiefly shone, how narrow is the circle which has been enlightened by its beams! The lower orders of society on the Continent, and even in Great Britain itself, notwithstanding the superior means of improvement they enjoy, are still miserably deficient in that degree of knowledge and information which every human being ought to possess; nor are there many even in the higher spheres of life who cultivate science for its own sake, who set a due value on intellectual acquisitions, or encourage the prosecution of rational inquiries.

There is, perhaps, no country in the world where the body of the people are better educated and more intelligent than in North Britain; yet we need not go far, either in the city or in the country, to be convinced that the most absurd and superstitious notions, and the grossest ignorance respecting many important subjects intimately connected with human happiness, still prevail among the great majority of the population. Of two millions of inhabitants which constitute the population of the northern part of our island, there are not perhaps 20,000, or the hundredth part of the whole, whose knowledge extends to any subject of importance, beyond the range of their daily avocations. With respect to the remaining 1,800,000, it may perhaps be said with propriety, that, of the figure and magnitude of the world they live in—of the seas and rivers, continents and islands, which diversify its surface, and of the various tribes of men and animals by which it is inhabited—of the nature and properties of the atmosphere which surrounds them—of the discoveries which have been made respecting light, heat, electricity, and magnetism—of the general laws which regulate the economy of nature—of the various combinations and effects of chymical and mechanical powers—of the motions and magnitudes of the planetary and the starry orbs—of the principles of legitimate reasoning—of just conceptions of the attributes and moral government of the Supreme Being—of the genuine principles of moral action—of many other subjects interesting to a rational and immortal being—they are almost as entirely ignorant as the wandering Tartar, or the untutored Indian.

Of eight hundred millions of human beings which people the globe we inhabit, there are not perhaps two millions whose minds are truly enlightened as they ought to be—who prosecute rational pursuits for their own sake, and from a pure love of science, independently of the knowledge requisite for their respective professions and employments.

For we must exclude from the rank of rational inquirers after knowledge all those who have acquired a smattering of learning, with no other view than to gain a subsistence, or to appear fashionable and polite. And, if this rule be admitted, I am afraid that a goodly number even of lawyers, physicians, clergymen, teachers, nay, even some authors, and professors in universities and academies, would be struck off from the list of lovers of science and rational inquirers after truth. Admitting this statement, it will follow, that there is not one individual out of four hundred of the human race that passes his life as a rational intelligent being, employing his faculties in those trains of thought and active exercises which are worthy of an intellectual nature! For, in so far as the attention of mankind is absorbed merely in making provision for animal subsistence, and in gratifying the sensual appetites of their nature, they can be considered as little superior in dignity to the lower orders of animated existence.

The late Frederick King of Prussia, who was a correct observer of mankind, makes a still lower estimate of the actual intelligence of the human species. In a letter to D'Alembert, in 1770, he says, "Let us take any monarchy you please; let us suppose that it contains ten millions of inhabitants; from these ten millions let us discount,—first the labourers, the manufacturers, the artisans, the soldiers, and there will remain about fifty thousand persons, men and women; from these let us discount twenty-five thousand for the female sex, the rest will compose the nobility and gentry, and the respectable citizens; of these let us examine how many will be incapable of application, how many imbecile, how many pusillanimous, how many dissipated,—and from this calculation it will result, that out of what is called a civilized nation of nearly ten millions, you will hardly find a thousand well informed persons, and even among them what inequality with regard to genius! If eight-tenths of the nation, toiling for their subsistence, never read—if another tenth are incapable of application, from frivolity, or dissipation, or imbecility,—it results, that the small share of good sense of which our species is capable can only reside in a small fraction of a nation." Such was the estimate made by this philosophic monarch of the intelligence possessed by the nations of Europe, sixty years ago; and although society has considerably advanced in intellectual acquisitions since that period, the great body of the people, in every country, is still shrouded in the mists of folly and ignorance.

Such a picture of the intellectual state of mankind must, when seriously considered, excite a melancholy train of reflections in the breast both of the philanthropist and the man of science. That such a vast assemblage of beings, furnished with powers capable of investigating the laws of nature,—of determining the arrangement, the motions, and magnitudes of distant worlds,—of weighing the masses of the planets,—of penetrating into the distant regions of the universe,—of arresting the lightning in its course,—of exploring the pathless ocean, and the region of the clouds,—and of rendering the most stubborn elements of nature subservient to their designs:—that beings capable of forming a sublime intercourse with the Creator himself, and of endless progression in knowledge and felicity, should have their minds almost wholly absorbed in eating and drinking, in childish and cruel sports and diversions, and in butchering one another, seems, at first view, a tacit reflection on the wisdom of the Creator, in bestowing on our race such noble powers, and plainly indicates, that the current of human intellect has widely deviated from its pristine course, and that strong and reiterated efforts are now requisite to restore it to its original channel. Every lover of science and of mankind must, therefore, feel interested in endeavouring to remove those obstructions which have impeded the progress of useful knowledge, and to direct the intellectual energies of his fellow-men to the prosecution of objects worthy of the high station they hold in the scale of existence.

Were we to inquire into the external causes which have retarded the progress of the human mind, we should doubtless find them existing in the nature of those civil governments which have most generally prevailed in the world, and in several of the ecclesiastical establishments which have been incorporated with them. It has been a favourite maxim with all tyrants that the people must be kept in ignorance; and hence we find, that in the empires of the East, which are all of a despotical nature, the people are debarred from the temple of science, and sunk into a state of the grossest ignorance and servility. Under such governments, the minds of men sink into apathy,—the sparks of genius are smothered,—the sciences are neglected,—ignorance is honoured,—and the man of discernment, who dares to vent his opinions is proscribed as an enemy to the state. In the more enlightened governments on the continent of Europe, the same effects have followed, in proportion to the number of those tyrannical maxims and principles which enter into their constitution. Hence, we may frequently determine the degree of mental illumination which prevails among any people, from a consideration of the nature of the government under which they live. For the knowledge of a people is always in proportion to their liberty, and where the spirit of liberty is either crushed or shackled, the energies of the human mind will never be exerted with vigour, in the acquisition or the propagation of literature and science. Even in the mildest and most enlightened governments of modern Europe, the instruction of the general mass of society forms no prominent feature in their administration. Knowledge on general subjects is simply *permitted* to be disseminated among the people; its promoters are not sufficiently patronised and encouraged,—no funds are regularly appropriated for this purpose,—and its utility, in many instances, is even called in question. It is to be hoped, however, now that the din of war is, in some measure, hushed, that the attention of princes and their ministers will be more particularly directed to this important object: for it might easily be shown, were it necessary, that an enlightened population is the most solid basis of a good government, and the greatest security for its permanence,—that it will always form the strongest bulwark around every throne where the sceptre is swayed by wisdom and rectitude.—That the establishment of the popish religion in any state has a tendency to impede the progress of knowledge, it would be almost needless to illustrate. The mummeries which have been interwoven with its services, the grovelling and superstitious notions which it has engendered, the ignorance which prevails among the population of all those countries over which its influence extends, the alarms of its priestly abetters at the idea of free discussion, and of enlightening the minds of the people, the records of its Inquisitions, the history of the dark ages, when it prevailed in all its rigour, and the recent experience of our own times, show, that it is a system founded on the darkness and imbecility of the human intellect, and can flourish only where the spirit of liberty has fled, and where reason has lost its ascendency in the minds of men.*

With regard to the internal causes of the ignorance which so generally prevails, they will be found in the general depravity of human nature; in the vicious propensities so prevalent among all ranks; in the indulgence of inordinate desires after riches and power; and in the general disposition of mankind to place their chief happiness in sensual gratifications,—evils which the spirit of Christianity only, in conjunction with every rational exertion, is calculated fully to eradicate. And therefore it is indispensable, that every attempt to diffuse intellectual light over the human race, be accompanied with the most strenuous exertions to promote the *moral renovation* of mankind. For vice and ignorance, especially among the lower orders, generally go hand in hand; and experience demonstrates, that indulgence in evil passions and in unhallowed gratifications, destroys the relish for mental enjoyments, and is one of the most powerful obstructions to the vigorous exercise of the intellectual powers.

That the general diffusion of knowledge among all ranks is an object much to be desired will not, I presume, be called in question by any one who regards the intellectual powers of man as the noblest part of his nature,—and who considers, that on the rational exercise of these powers his true happiness depends. If ignorance be one of the chief causes which disturb the harmonious movements of the machine of society, by removing the cause we of course prevent the effects; and if knowledge be one of the mainsprings of virtuous conduct, the more it is diffused, the more extensively will be brought into action, on the stage of life, those virtues which it has a tendency to produce. A few Ferdinands, and Windhams, and Don Miguels may still remain, who regard the great mass of the people merely as subjects of legislation, or as the tools of tyranny and ambition; and that, therefore, they must be held in the chains of ignorance, lest they should aspire to the ranks of their superiors. But the general current of public opinion now runs counter to such illiberal and antiquated notions; and few persons of respectability, at least in this country, would hazard their reputation in defending a position so degrading and untenable. The more learning a people have, the more virtuous, powerful, and happy will they become; and to ignorance alone must the contrary effects be imputed. "There is but one case," says a French writer, "where ignorance can be desirable; and that is, when all is desperate in a state, and when, through the present evils, others still greater appear behind. Then stupidity is a blessing: knowledge and foresight are evils. It is then that, shutting our eyes against the light, we would hide from ourselves the calamities we cannot prevent." In every other case, knowledge must prove an inestimable blessing to men of every nation and of every rank.

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* Let it be carefully remembered, that in these remarks, it is merely the *system* of popery to which the author refers. He is aware that many individuals, distinguished for learning and piety, have been connected with the Romish church; and while he condemns the spirit and tendency of the peculiar dogmas and practices of that church, he deprecates every idea of persecution, and every attempt to deprive its members of those rights and privileges to which they are entitled as men and as citizens.

That the period when a general diffusion of knowledge shall take place is hastening on appears from the rapid progress which has been made in almost every department of science during the last half-century; from the numerous publications on all subjects daily issuing from the press; from the rapid increase of theological, literary, and scientific journals, and the extensive patronage they enjoy; from the numerous lectures on chymistry, astronomy, experimental philosophy, political economy, and general science, now delivered in the principal cities and towns of Europe; from the adoption of new and improved plans of public instruction, and the erection of new seminaries of education in almost every quarter of the civilized world; from the extensive circulation of books among all classes of the community; from the rapid formation of Bible and missionary societies; from the increase of literary and philosophical associations; from the establishment of mechanics' institutions in our principal towns, and of libraries and reading societies in almost every village; from the eager desire now excited, even among the lower orders of society, of becoming acquainted with subjects hitherto known and cultivated only by persons of the learned professions; and, above all, from the spirit of civil and religious liberty now bursting forth, both in the eastern and the western hemispheres, notwithstanding the efforts of petty tyrants to arrest its progress. Amid the convulsions which have lately shaken the surrounding nations, "many have run to and fro, and knowledge has been increased;" the sparks of liberty have been struck from the collision of hostile armies and opposing interests; and a spirit of inquiry has been excited among numerous tribes of mankind, which will doubtless lead to the most important results. These circumstances, notwithstanding some gloomy appearances in the political horizon, may be considered as so many preludes of a new and happier era about to dawn upon the world; when intellectual light shall be diffused among all ranks, and in every region of the globe, when Peace shall extend her empire over the world; when men of all nations, at present separated from each other by the effects of ignorance, and of political jealousies, shall be united by the bonds of love, of reason, and intelligence, and conduct themselves as rational and immortal beings.

In order that such a period may be gradually ushered in, it is essentially requisite that a conviction of the utility and importance of a general diffusion of knowledge be impressed upon the minds of the more intelligent and influential classes of society, and that every exertion and every appropriate means should be used to accomplish this desirable object. In accordance with this idea, I shall endeavour, in the following work,

I. To illustrate the *advantages* which would flow from a general diffusion of useful knowledge among all ranks,—and shall afterward follow out the investigation, by

II. An inquiry into the *means* requisite to be used in order to accomplish this important object.*

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* As a particular illustration of the *means* by which a general diffusion of knowledge might be effected would render the present work too bulky, this department of the subject will be prosecuted in a separate volume.

ON THE

GENERAL DIFFUSION OF KNOWLEDGE.

PART I.

On the Advantages which would flow from a General Diffusion of Knowledge.

THAT the intellectual faculties of man have never been thoroughly directed to the pursuit of objects worthy of the dignity of rational and immortal natures,—and that the most pernicious effects have flowed from the perversion of their mental powers,—are truths which the history of past ages, and our own experience, too plainly demonstrate. That the state of general society would be greatly meliorated were the mists of ignorance dispelled, and the current of human thought directed into a proper channel, might appear, were we to take an extensive survey of the evils which have been produced by ignorance, and its necessary concomitants, and of the opposite effects which would flow from mental illumination, in relation to all those subjects connected with the improvement and the happiness of our species. Here, however, a field of vast extent opens to view, which would require several volumes fully to describe and illustrate: I shall, therefore, in the mean time, select, from the multitude of objects which crowd upon the view, only a few prominent particulars,—the elucidation of which shall occupy the following sections.

SECTION I.

On the Influence which a General Diffusion of Knowledge would have in dissipating those SUPERSTITIOUS NOTIONS *and Vain Fears which have so long enslaved the Minds of Men.*

MY first proposition is, that the diffusion of knowledge would undermine the fabric of *superstition*, and remove those groundless fears to which superstitious notions give rise. Ignorance has not only debarred mankind from many exquisite and sublime enjoyments, but has created innumerable unfounded alarms which greatly increase the sum of human misery. Man is naturally timid, terrified at those dangers whose consequences he cannot foresee, and at those uncommon appearances of nature whose causes he has never explored. Thus he is led, in many instances, to regard with apprehension and dread those operations of nature which are the result of regular and invariable laws. Under the influence of such timid emotions, the phenomena of nature, both in the heavens and on the earth, have been arrayed with imaginary terrors. In the early ages of the world, a total eclipse of the sun or of the moon was regarded with the utmost consternation, as if some dismal catastrophe had been about to befall the universe. Believing that the moon in an eclipse was sickening or dying through the influence of enchanters, the trembling spectators had recourse to the ringing of bells, the sounding of trumpets, the beating of brazen vessels, and to loud and horrid exclamations, in order to break the enchantment, and to drown the muttering of witches that the moon might not hear them. In allusion to this practice, Juvenal, when speaking of a loud scolding woman, says that she was able to relieve the moon.

> "Forbear your drums and trumpets, if you please;
> Her voice alone the labouring moon can ease."

Nor are such foolish opinions and customs yet banished from the world. They are said to be still prevalent in several Mohammedan and Pagan countries.* Comets, too, with their blazing tails, were long regarded, and still are, by the vulgar, as harbingers of Divine vengeance, presaging famines and inundations, or the downfall of princes and the destruction of empires.† The Auroræ Boreales, or northern lights, have been frequently gazed at with similar apprehensions, and whole provinces have been thrown into consternation by the fantastic coruscations of those lambent meteors. Some pretend to see, in these harmless lights, armies mixing in fierce encounter, and fields streaming with blood; others behold states overthrown, earthquakes, inundations, pestilences, and the most dreadful calamities. Because some one or other of these calamities formerly happened soon after the appearance of a comet, or the blaze of an aurora, therefore they are considered either as the causes or the prognostics of such events.

From the same source have arisen those foolish notions, so fatal to the peace of mankind, which have been engendered by *judicial astrology*. Under a belief that the characters and the fates of men are dependent on the various aspects of the stars, and conjunctions of the planets, the most unfounded apprehensions, as well as the most delusive hopes, have been excited by the professors of this fallacious science. Such impositions on the credulity of mankind are founded on the grossest absurdity, and the most palpable ignorance of the nature of things; for since the aspects and conjunctions of the celestial bodies have, in every period of duration, been subject to invariable laws, they must be altogether inadequate to account for the diversified phenomena of the moral world, and for that infinite variety we observe in the dispositions and the destinies of men; and, indeed, the single consideration of the immense distancee of the stars from our globe, is sufficient to convince any rational mind that their influence can have no effect on a region so remote from the spaces which they occupy. The planetary bodies, indeed, may, in certain cases, have some degree of *physical* influence on the earth, by virtue of their attractive power, but that influence can never affect the operation of moral causes, or the qualities of the mind. Even although it were admitted that the heavenly bodies have an influence over the destinies of the human race, yet we have no *data* whatever by which to ascertain the mode of its operation, or to determine the formula or rules by which calculations are to be made, in order to predict the fates of nations, or the individual temperaments and destinies of men; and consequently, the principles and rules on which astrologers proceed in constructing *horoscopes*, and calculating nativities, are nothing else than mere assumptions, and their pretensions nothing short of criminal impositions upon the credulity of mankind. With equally the same reason might we assert, that the earth, in different positions in its orbit, would have an influence in producing fools and maniacs in the planet Jupiter, or in exciting wars and insurrections among the inhabitants of Saturn, as to suppose, with Mr. Varley, the prince of modern astrologers, that "Saturn passing through the *ascendant* causes dulness and melancholy for a few weeks," and that "Jupiter, in the third house, gives safe inland journeys and agreeable neighbours or kindred."

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* See Appendix, No. II.

† *Ibid.*

Notwithstanding the absurdity of the doctrines of astrology, this art has been practised in every period of time. Among the Romans, the people were so infatuated with it, that the astrologers, or, as they were then called, the *mathematicians*, maintained their ground in spite of all the edicts of the emperors to expel them from the capital; and after they were at length expelled by a formal decree of the senate, they found so much protection from the credulity of the people, that they still remained in Rome unmolested. Among the Chaldeans, the Assyrians, the Egyptians, the Greeks, and the Arabians, in ancient times, astrology was uniformly included in the list of the sciences, and used as one species of divination by which they attempted to pry into the secrets of futurity. The Brahmins in India, at an early period, introduced this art into that country, and, by means of it, have rendered themselves the arbiters of good and evil hours, and of the fortunes of their fellow-men, and have thus raised themselves to great authority and influence among the illiterate multitude. They are consulted as oracles, and, like all other impostors, they have taken great care never to sell their answers without a handsome remuneration. In almost every country in the world this art is still practised, and only a short period has elapsed since the princes and legislators of *Europe* were directed in the most important concerns of the state by the predictions of astrologers. In the time of Queen Catharine de Medicis, astrology was so much in vogue, that nothing, however trifling, was to be done without consulting the stars. The astrologer Morin, in the seventeenth century, directed Cardinal Richelieu's motions in some of his journeys, and Louisa Maria de Gonzaga, Queen of Poland, gave 2000 crowns to carry on an edition of his *Astrologia Gallica;* and in the reigns of Henry the Third and Henry the Fourth of France, the predictions of astrologers were the common theme of the court conversation. Even in the present day, and in the metropolis of the British empire, this fallacious art is practised, and its professors are resorted to for judicial information, not only by the vulgar, but even by many in the higher spheres of life. The extensive annual sale of more than 240,000 copies of "Moore's Almanac," which abounds with such predictions, and of similar publications, is a striking proof of the belief which is still attached to the doctrines of astrology in our own age and country, and of the ignorance and credulity from which such a belief proceeds.* Parhelia, paraselenæ, shooting stars, fiery meteors, luminous arches, lunar rainbows, and other atmospherical phenomena, have likewise been considered by some as ominous of impending calamities.

Such are some of the objects in the *heavens,* which ignorance and superstition have arrayed with imaginary terrors.

On the *earth,* the objects which have given rise to groundless fears are almost innumerable. The *ignes fatui,* those harmless meteors which hover above moist and fenny places in the night-time, and emit a glimmering light, have been regarded as malicious spirits, endeavouring to deceive the bewildered traveller, and lead him to destruction. The ticking noise of the little insect called the *death-watch*—a screech-owl screaming at the window—a raven croaking over a house—a dog howling in the night-time—a hare or a sow crossing the road—the meeting with a bitch with whelps, or a snake lying in the road—the falling of salt from a table—and even the curling of a fibre of tallow in a burning candle,* have been regarded with apprehensions of terror, as prognostics of impending disasters, or of approaching death.

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* That the absurdities of astrology are still in vogue among a certain class appears from the publication of such works as the following:—"A Treatise on Zodiacal Physiognomy, illustrated by engravings of heads and features, and accompanied by tables of the times of the rising of the twelve signs of the Zodiac, and containing also new *astrological* explanations of some remarkable portions of ancient mythological history. By John Varley. No. I., large 8vo., pp. 60, to be comprised in four parts. Longman and Co., 1828." A specimen of some of the fooleries and absurdities gravely treated on by this sapient author will be found in Nos. III. and IV. of the Appendix to this volume.

In the Highlands of Scotland, the motions and appearances of the clouds were, not long ago, considered as ominous of disastrous events. On the evening before new year's day, if a black cloud appeared in any part of the horizon, it was thought to prognosticate a plague, a famine, or the death of some great man in that part of the country over which it seemed to hang; and in order to ascertain the place threatened by the omen, the motions of the cloud were often watched through the whole night. In the same country, the inhabitants regard certain days as *unlucky*, or ominous of bad fortune. That day of the week on which the 3d of May falls is deemed unlucky throughout the whole year. In the isle of Mull, ploughing, sowing, and reaping are always begun on Tuesday, though the most favourable weather for these purposes be in this way frequently lost. In Morven none will, upon any account, dig peat or turf for fuel on Friday. The age of the moon is also much attended to by the vulgar Highlanders; and an opinion prevails, that if a house take fire while the moon is in the decrease, the family will from that time decline in its circumstances, and sink into poverty.†

In England, it is reckoned a bad omen to break a looking-glass, as it is believed the party to whom it belongs will lose his best friend. In going a journey, if a sow cross the road, it is believed the party will meet either with a disappointment or a bodily accident before returning home. It is reckoned unlucky to see first one magpie, and then another; and to kill a magpie, it is believed, will certainly be punished with some terrible misfortune. If a person meet a funeral procession, it is considered necessary always to take off the hat, which keeps all the evil spirits that attend the body in good-humour. If, in eating, a person miss his mouth, and the victuals fall, it is reckoned very unlucky, and ominous of approaching sickness. It is also considered as unlucky to present a knife, scissors, razor, or any sharp cutting instrument, to one's mistress or friend, as they are apt to cut love and friendship; and to find a knife or razor denotes ill luck or disappointment to the party.

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* Called in Scotland, the *dead speal.*

† Encyclopædia Britannica, Art. *Omen.*

Among the ancient nations, there was hardly any circumstance or occurrence, however trivial, from which they did not draw omens. This practice appears to have taken its rise in Egypt, the parent country of almost every superstition of paganism; but from whatever source it may have derived its origin, it spread itself over the whole inhabited globe, even among the most civilized nations, and at this day it prevails more or less among the vulgar in every country. Even kings and emperors, sages and heroes, have been seized with alarm at the most trivial circumstances, which they were taught to consider as ominous of bad fortune, or of impending danger. Suetonius says of Augustus, that he believed implicitly in certain omens; and that, *si mane sibi calceus perperam, ac sinister pro dextero induceretur, ut dirum*,—"if his shoes were improperly put on in the morning, especially if the left shoe was put upon his right foot, he held it for a bad omen."

Thus it appears, that the luminaries of heaven, the clouds, and other meteors that float in the atmosphere, the actions of animals, the seasons of the year, the days of the week, the most trivial incidents in human life, and many other circumstances, have afforded matter of false alarm to mankind. But this is not all: man, ever prone to disturb his own peace, notwithstanding the *real* evils he is doomed to suffer, has been ingenious enough to form *imaginary* monsters which have no existence, either in heaven or on earth, nor the least foundation in the scenes of external nature. He has not only drawn false conclusions from the objects which have a real existence, to increase his fears; but has created, in his imagination, an *ideal world*, and peopled it with spectres, hobgoblins, fairies, satyrs, imps, wraiths, genii, brownies, witches, wizards, and other fantastical beings, to whose caprices he believes his happiness and misery are subjected. An old wrinkled hag is supposed to have the power of rendering miserable all around her, who are the objects of her hatred. In her privy chamber, it is believed, she can roast and torment the absent, and inflict incurable disorders both on man and beast;* she can transport herself through the air on a spit or a broomstick; or, when it serves her purpose, she can metamorphose herself into a cat or a hare; and by shaking a bridle over a person asleep, can transform him into a horse; and, mounted on this new-created steed, can traverse the air on the wings of the wind, and visit distant countries in the course of a night. A certain being called a fairy, though supposed to be at least two or three feet high, is believed to have the faculty of contracting its body, so as to pass through the keyhole of a door; and though they are a distinct species of beings from man, they have a strong fancy for children; and hence, in the Highlands of Scotland, new-born infants are watched till the christening is over, lest they should be stolen or exchanged by those fantastic existences. The regions of the air have been peopled with apparitions and terrific phantoms of different kinds, which stalk abroad at the dead hour of night to terrify the lonely traveller. In ruined castles and old houses, they are said to announce their appearance by a variety of loud and dreadful noises; sometimes rattling in the old hall like a coach and six, and rumbling up and down the staircase like the trundling of bowls or cannon-balls. Especially in lonely church-yards, in retired caverns, in deep forests and dells, horrid sounds are said to have been heard, and monstrous shapes to have appeared, by which whole villages have been thrown into consternation.†

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* The reader will find abundance of relations of this kind in "*Satan's Invisible World discovered*,"—a book which was long read with avidity by the vulgar in this country, and which has frequently caused emotions of terror among youthful groups on winter evenings, while listening to its fearful relations, which could never be eradicated, and has rendered them *cowards* in the dark during all the subsequent periods of their lives.

† That many of the superstitious opinions and practices above alluded to still prevail even within the limits of the British empire, appears from the following extract from the

Nor have such absurd notions been confined to the illiterate vulgar; men of considerable acquirements in literature, from ignorance of the laws of nature, have fallen into the same delusions. Formerly, a man who was endowed with considerable genius and knowledge was reckoned a magician. Doctor Bartolo was seized by the Inquisition at Rome, in the sixteenth century, because he unexpectedly cured a nobleman of the gout; and the illustrious Friar Bacon, because he was better acquainted with experimental philosophy than most persons of the age in which he lived, was suspected, even by the learned ecclesiastics, of having dealings with the devil. Diseases were at those times imputed to *fascination*, and hundreds of poor wretches were dragged to the stake for being accessory to them. Mercatus, physician to Philip II. of Spain, relates, that he

"Monthly Magazine" for July, 1813, p. 496. "In Staffordshire, they burn a calf in a farm-house alive, to prevent the other calves from dying. In the same county, a woman having kept a toad in a pot in her garden, her husband killed it, and she reproached him for it, saying, she intended the next Sunday to have taken the sacrament for the purpose of getting some of the bread to feed him with, and make him thereby a valuable familiar spirit to her. At Long Aston, a young farmer has several times predicted his own end, from what he calls being *looked over;* and his mother and father informed a friend of mine (says the relater) that they had sent to the white witch doctor, beyond Bridgewater, by the coachman, for a charm to cure him (having paid handsomely for it); but that he had now given him over, as her spells were more potent than his. If not dead, he is dying of mere fear, and all the parish of his class believe it. There is also, in that parish, an old man who sells gingerbread to the schools, who is always employed to cure the *red water* in cows, by means of charms and verses which he says to them. In the Marsh, we have water doctors who get rich; at the mines, diviners with rods, who find ores and water; and at Weston-super-Mare, they see lights before funerals, and are agreed that the people in that parish always die by threes, *i. e.* three old, three young, three men, three women, &c. Such are a part only of the superstitions of the west in 1813!"

Every one who is much conversant with the lower ranks of society will find that such notions are still current and believed by a considerable portion of the population, which is the only apology that can be made for stating and counteracting such opinions.

had seen a very beautiful woman break a steel mirror to pieces, and blast some trees by a single glance of her eyes! Josephus relates, that he saw a certain Jew, named Eleazar, draw the devil out of an old woman's nostrils, by the application of Solomon's seal to her nose, in the presence of Vespasian. Dr. Mynsight is said to have cured several bewitched persons with a plaster of asafœtida. How the asafœtida was efficacious was much disputed among the learned. Some thought the devil might consider such an application as an insult, and ran off in a passion; but others very sagely observed, that as devils were supposed to have eyes and ears, it was probable they might have *noses* too. James VI., who was famed for his polemics and theological acquirements, wrote a treatise in defence of witchcraft, and persecuted those who opposed his opinions on this subject. The pernicious effects in mines, occasioned by the explosion of hydrogen gas, were formerly imputed to the demons of the mine. Van Helmont, Bodinus, Strozza, and Luther attributed thunder and meteors to the devil. Socrates believed he was guided by a demon. Dr. Cudworth, Glanville, and others wrote in defence of witchcraft and apparitions. But it would be endless to detail all the foolish opinions which have been imbibed and propagated even by men who pretended to genius and learning.

Besides the opinions to which I have now adverted, and which have a direct tendency to fill the mind with unnecessary apprehensions, there is also an immense variety of foolish and erroneous opinions which pass current for genuine truths among a great majority of mankind. That a man has one rib less than a woman,—that there is a certain Jew still alive who has wandered through the world since the crucifixion of Christ,—that the coffin of Mahomet is suspended in the air between two loadstones,—that the city of Jerusalem is in the centre of the world,—that the tenth wave of the sea is greater and more dangerous than all the rest,—that all animals on the land have their corresponding kinds in the sea,—that there is a white powder which kills without giving a report,—that the blood of a goat will dissolve a diamond,—that all the stars derive their light from the sun,—that a candle made of human fat, when lighted, will prevent a person asleep from awaking, with many other similar unfounded positions,—are regarded as indisputable truths by thousands, whose adherence to tradition and authority, and whose indolence and credulity, prevent them from inquiring, with a manly independence, into the true state and nature of things.

Such are a few, and but a very few, of the superstitious notions and vain fears by which the great majority of the human race, in every age and country, has been enslaved. To have attempted a complete enumeration of such hallucinations of the human intellect would have been vain, and could only have produced satiety and disgust. That such absurd notions should ever have prevailed is a most grating and humiliating thought, when we consider the noble faculties with which man is endowed. That they still prevail in a great measure, even in our own country, is a striking proof that we are, as yet, but just emerging from the gloom of intellectual darkness. The prevalence of such opinions is to be regretted, not only on account of the groundless alarms they create, but chiefly on account of the false ideas they inspire with regard to the nature of the Supreme Ruler of the universe, and of his arrangements in the government of the world. While a man whose mind is enlightened with true science perceives throughout all nature the most striking evidences of benevolent design, and rejoices in the benignity of the Great Parent of the universe, —while he perceives nothing in the arrangements of the Creator, in any department of his works, which has a direct tendency to produce pain to any intelligent or sensitive existence,—the superstitious man, on the contrary, contemplates the sky, the air, the waters, and the earth as filled with malicious beings ever ready to haunt him with terror, or to plot his destruction. The one contemplates the Deity directing the movements of the material world by fixed and invariable laws, which none but himself can counteract or suspend; the other views them as continually liable to be controlled by capricious and malignant beings, to gratify the most trivial and unworthy passions. How very different, of course, must be their conceptions and feelings respecting the attributes and government of the Supreme Being! While the one views Him as an infinitely wise and benevolent Father, whose paternal care and goodness inspire confidence and affection; the other must regard him, in a certain degree, as a capricious being, and offer up his adorations under the influence of fear.

Such notions have likewise an evident tendency to habituate the mind to false principles and processes of reasoning, which unfit it for forming legitimate conclusions in its researches after truth. They chain down the understanding, and sink it into the most abject and sordid state; and prevent it from rising to those noble and enlarged views which revelation and modern science exhibit, of the order, the extent, and the economy of the universe. It is lamentable to reflect, that so many thousands of beings endowed with the faculty of reason, who cannot by any means be persuaded of the motion of the earth, and the distances and magnitudes of the celestial bodies, should swallow, without the least hesitation, opinions ten thousand times more improbable; and find no difficulty in believing that an old woman can transform herself into a *hare*, and wing her way through the air on a broomstick.

But, what is worst of all, *such notions almost invariably lead to the perpetration of deeds of cruelty and injustice.* Of the truth of this position the history of almost every nation affords the most ample proof. Many of the barbarities committed in pagan countries, both in their religious worship and their civil polity, and most of the cruelties inflicted on the victims of the Romish Inquisition, have flowed from this source.* Nor are the annals of our own country deficient in examples of this kind. The belief attached to the doctrine of witchcraft led our ancestors, little more than a century ago, to condemn and to burn at the stake hundreds of unhappy women, accused of crimes of which they could not possibly have been guilty.† In New-England, about the year 1692, a witchcraft phrensy rose to such excess as to produce commotions and calamities more dreadful than the scourge of war or the destroying pestilence. There lived in the town of *Salem*, in that country, two young women who were subject to convulsions, accompanied with extraordinary symptoms. Their father, minister of the church, supposing they were *bewitched*, cast his suspicions upon an Indian girl who lived in the house, whom he compelled, by harsh treatment, to confess that she was a witch. Other women, on hearing this, immediately believed that the convulsions, which proceeded only from the nature of their sex, were owing to the same cause. Three citizens casually named, were immediately thrown into prison, accused of witchcraft, hanged, and their bodies left exposed to wild beasts and birds of prey. A few days after, sixteen other persons, together with a counsellor, who, because he refused to plead against them, was supposed to share in their guilt, suffered in the same manner. From this instant, the imagination of the multitude was inflamed with these horrid and gloomy scenes. Children of ten years of age were put to death, young girls were stripped naked, and the marks of witchcraft searched for upon their bodies with the most indecent curiosity; and those spots of the scurvy which age impresses upon the bodies of old men were taken for evident signs of infernal power. In default of these, torments were employed to extort confessions, dictated by the executioners themselves. For such fancied crimes, the offspring of superstition alone, they were imprisoned, tortured, murdered, and their bodies devoured by the beasts of prey. If the magistrates, tired out with executions, refused to punish, they were themselves accused of the crimes they tolerated; the very ministers of religion raised false witnesses against them, who made them forfeit with their lives the tardy remorse excited in them by humanity. Dreams, apparitions, terror, and consternation of every kind increased these prodigies of folly and horror. The prisons were filled, the gibbets left standing, and all the citizens

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* In the duchy of Lorraine, 900 females were delivered over to the flames, for being *witches*, by one inquisitor alone. Under this accusation, it is reckoned that upwards of *thirty thousand women* have perished by the hands of the Inquisition.—"*Inquisition Unmasked*," by Puigblanch.

† The Scots appear to have displayed a more than ordinary zeal against witches, and it is said that more deranged old women were condemned for this imaginary crime in Scotland than in any other country. So late as 1722, a poor woman was burnt for witchcraft, which was among the last executions in Scotland. A variety of curious particulars in relation to the

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trials of witches may be seen in Pitcairn's "Criminal Trials, and other proceedings before the High Court of Justiciary in Scotland."—Part II. lately published. See also Appendix, No. V.

involved in gloomy apprehensions. So that superstitious notions, so far from being innocent and harmless speculations, lead to the most deplorable results; and, therefore, ought to be undermined and eradicated by every one who wishes to promote the happiness and the good order of general society.

Such, then, is the evil we find existing among mankind —false opinions, which produce vain fears, which debase the understanding, exhibit distorted views of the Deity, and lead to deeds of cruelty and injustice. Let us now consider the remedy to be applied for its removal.

I have all along taken it for granted, that ignorance of the laws and economy of nature is the great source of the absurd opinions to which I have adverted,—a position which, I presume, will not be called in question. For such opinions cannot be deduced from an attentive survey of the phenomena of nature, or from an induction of well authenticated facts; and they are equally repugnant to the dictates of revelation. Nay, so far are they from having any foundation in nature or experience, that in proportion as we advance in our researches into nature's economy and laws, in the same proportion we perceive their futility and absurdity. As in most other cases, so in this, a knowledge of the cause of the evil leads to the proper remedy. Let us take away the cause, and the effect of course will be removed. Let the exercise of the rational faculties be directed into a proper channel, and the mind furnished with a few fundamental and incontrovertible principles of reasoning—let the proper sources of information be laid open—let striking and interesting facts be presented to view, and a taste for rational investigation be encouraged and promoted—let habits of accurate observation be induced, and the mind directed to draw proper conclusions from the various objects which present themselves to view,—and then we may confidently expect that superstitious opinions, with all their usual accompaniments, will gradually vanish, as the shades of night before the rising sun.

But here it may be inquired, *What kind of knowledge* is it that will produce this effect? It is not merely an acquaintance with a number of dead languages, with Roman and Grecian antiquities, with the subtleties of metaphysics, with pagan mythology, with politics or poetry: these, however important in other points of view, will not, in the present case, produce the desired effect; for we have already seen that many who were conversant in such subjects were not proof against the admission of superstitious opinions. In order to produce the desired effect, the mind must be directed to the study of material nature,—to contemplate the various appearances it presents, and to mark the uniform results of those invariable laws by which the universe is governed. In particular, the attention should be directed to those discoveries which have been made by philosophers in the different departments of nature and art during the two last centuries. For this purpose, the study of natural history, as recording the various facts respecting the atmosphere, the waters, the earth, and animated beings, combined with the study of natural philosophy and astronomy, as explaining the causes of the phenomena of nature, will have a happy tendency to eradicate from the mind those false notions, and, at the same time, will present to view objects of delightful contemplation. Let a person be once thoroughly convinced that nature is uniform in her operations, and governed by regular laws, impressed by an all-wise and benevolent Being, he will soon be inspired with confidence, and will not easily be alarmed at any occasional phenomena which at first sight might appear as exceptions to the general rule.

For example,—let persons be taught that eclipses are occasioned merely by the shadow of one opaque body falling upon another—that they are the necessary result of the inclination of the moon's orbit to that of the earth—that the times when they take place depend on the new or full moon happening at or near the points of intersection—and that other planets which have moons experience eclipses of a similar nature—that the *comets* are regular bodies belonging to our system, which finish their revolutions, and appear and disappear in stated periods of time—that the northern lights, though seldom seen in southern climes, are frequent in the regions of the north, and supply the inhabitants with light in the absence of the sun, and have probably a relation to the magnetic and electric fluids—that the *ignes fatui* are harmless lights, formed by the ignition of a certain species of gas produced in the soils above which they hover—that the notes of the death-watch, so far from being presages of death, are ascertained to be the notes of *love*, and presages of hymeneal intercourses among these little insects;* let rational information of this kind be imparted, and they will soon learn to contemplate nature with tranquillity and composure. Nay, a more beneficial effect than even this will, at the same time, be produced. Those objects which they formerly beheld with alarm will now be converted into sources of enjoyment, and be contemplated with emotions of delight.

> "When from the dread immensity of space
> The rushing comet to the sun descends,
> With awful train projected o'er the world;
> ——————The enlighten'd few,
> Whose god-like minds philosophy exalts,
> The glorious stranger hail. They feel a joy
> Divinely great; they in their powers exult;
> They see the blazing wonder rise anew,
> In seeming terror clad, but kindly bent
> To work the will of All-sustaining Love."
> *Thomson's Summer.*

Such are the sublime emotions with which a person enlightened with the beams of science contemplates the return of a comet, or any uncommon celestial appearance. He will wait the approach of such phenomena with pleasing expectation, in hopes of discovering more of the nature and destination of those distant orbs; and will be led to form more enlarged ideas of their omnipotent Creator.

Again, to remove the apprehensions which arise from the fear of invisible and incorporeal beings, let persons be instructed in the various optical illusions to which we are subject, arising from the intervention of fogs, and the indistinctness of vision in the night-time, which make us frequently mistake a bush that is near us for a large tree at a distance; and, under the influence of which illusions, a timid imagination will transform the indistinct image of a cow or a horse, into a terrific phantom of a monstrous size. Let them also be taught, by a selection of well-authenticated facts, the powerful influence of the imagination in creating ideal forms, especially when under the dominion of fear—the effects produced by the workings of conscience, when harassed with guilt—by very lively dreams, by strong doses of opium, by drunkenness, hysteric passions, madness, and other disorders that affect the mind, and by the cunning artifices of impostors to promote some sinister or nefarious designs. Let them likewise be instructed in the nature of *spontaneous combustions and detonations*, occasioned by the accidental combustion and explosion of gases, which produce occasional noises and lights in churchyards and empty houses. Let the experiments of optics, and the striking phenomena produced by electricity, galvanism, magnetism, and the different gases, be exhibited to their view, together with details of the results which have been produced by various mechanical contrivances. In fine, let their attention be directed to the foolish, whimsical, and extravagant notions attributed to apparitions, and to their inconsistency with the wise and benevolent arrangements of the Governor of the universe.*

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* This fact was particularly ascertained by Dr. Derham.—*Philosophical Transactions*, No. 291.

That such instructions as those I have now hinted at would completely produce the intended effect may be argued from this consideration,—*that they have uniformly produced this effect on every mind which has been thus enlightened.* Where is the man to be found whose mind is enlightened in the doctrines and discoveries of modern science, and who yet remains the slave of superstitious notions and vain fears? Of all the philosophers in Europe, is there one who is alarmed at an eclipse, at a comet, at an *ignis fatuus*, or the notes of a death-watch, or who postpones his experiments on account of what is called an unlucky day? Did we ever hear of a spectre appearing to such a person dragging him from bed at the dead hour of midnight to wander through the forest trembling with fear?—No. Such beings appear only to the ignorant and illiterate; and we never heard of their appearing to any one who did not previously believe in their existence. But why should philosophers be freed from such terrific visions, if substantial knowledge had not the power of banishing them from the mind? Why should supernatural beings feel so shy in conversing with men of science? They would be the fittest persons to whom they might impart their secrets, and communicate information respecting the invisible world, but it never falls to their lot to be favoured with such visits. Therefore, it may be concluded, that the diffusion of useful knowledge would infallibly dissipate those groundless fears which have so long disturbed the happiness particularly of the lower orders of mankind.*

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* See Appendix, No. VII., for an illustration of some of the causes which have concurred to propagate the belief of apparitions.

It forms no objection to what has been now stated, that the late Dr. Samuel Johnson believed in the existence of ghosts and in the *second sight*; for, with all his vast acquirements in literature, he was ignorant of natural science, and even attempted to ridicule the study of natural philosophy and astronomy,—the principal subjects which have the most powerful tendency to dissipate such notions,—as may be seen in No. 24 of his "Rambler;" where he endeavours to give force to his ridicule by exhibiting the oddities of an imaginary pretender to these sciences. He talks of men of science "lavishing their hours in calculating the weight of the terraqueous globe, or in adjusting systems of worlds beyond the reach of the telescope;" and adds, that "it was the greatest praise of Socrates, that he drew the wits of Greece from the *vain pursuit of natural philosophy* to moral inquiries, and turned their thoughts from stars and tides, and matter and motion, upon the various modes of virtue and relations of life." His opinions and conduct, therefore, can only be considered as an additional proof of the propriety of the sentiments above expressed.

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* It would be unfair to infer from any expressions here used, that the author denies the possibility of supernatural visions and appearances. We are assured from the records of Sacred History, that beings of an order superior to the human race have "at sundry times, and in diverse manners," made their appearance to men. But there is the most marked difference between vulgar apparitions, and the celestial messengers to which the records of Revelation refer. They appeared, not to old women and clowns, but to patriarchs, prophets, and apostles. They appeared, not to frighten the timid, and to create unnecessary alarm, but to declare "tidings of great joy." They appeared, not to reveal such paltry secrets as the place where a pot of gold or silver is concealed, or where a lost ring may be found; but to communicate intelligence worthy of God to reveal, and of the utmost importance for man to receive. In these, and many other respects, there is the most striking contrast between popular ghosts, and the supernatural communications and appearances recorded in Scripture.

Nor should it be considered as a thing impracticable to instruct the great body of mankind in the subjects to which I have alluded. Every man possessed of what is called common sense is capable of acquiring all the information requisite for the purpose in view, even without infringing on the time allotted for his daily labours, provided his attention be once thoroughly directed to its acquisition, and proper means used to promote his instruction. It is not intended that all men should be made profound mathematicians and philosophers; nor is it necessary, in order to eradicate false opinions, and to enlarge and elevate the mind. A general view of useful knowledge is all that is necessary for the great mass of mankind; and would certainly be incomparably preferable to that gross ignorance, and those grovelling dispositions, which so generally prevail among the inferior ranks of society. And to acquire such a degree of rational information requires only that a taste for it, and an eager desire for acquiring it, be excited in the mind. If this were attained, I am bold to affirm, that the acquisition of such information may be made by any person who is capable of learning a common mechanical employment, and will cost him less trouble and expense than are requisite to a schoolboy for acquiring the elements of the Latin tongue.

To conclude this branch of the subject:—Since it appears that ignorance produces superstition, and superstitious notions engender vain fears and distorted views of the government of the Almighty,—since all fear is in itself painful, and, when it conduces not to safety, is painful without use,—every consideration and every scheme by which groundless terrors may be removed, and just conceptions of the moral attributes of the Deity promoted, must diminish the sum of human misery, and add something to human happiness. If therefore the acquisition of useful knowledge respecting the laws and the economy of the universe would produce this effect, the more extensively such information is propagated, the more happiness will be diffused among mankind.

SECTION II.

On the Utility of Knowledge in preventing Diseases and fatal Accidents.

It is a conclusion which has been deduced from long experience, "that mankind in their opinions and conduct are apt to run from one extreme to another." We have already seen, that, in consequence of false conceptions of the Deity, and of his arrangements in the economy of nature, the minds of multitudes have been alarmed by the most unfounded apprehensions, and have been "in great fear where no fear was." On the other hand, from a similar cause, many have run heedlessly into danger and destruction, when a slight acquaintance with the powers of nature, and the laws of their operation, would have pointed out the road to safety. This leads me to the illustration of another advantage which would be derived from a general diffusion of knowledge,—namely,

That it would tend to prevent many of those diseases and fatal accidents which flow from ignorance of the laws which govern the operations of nature.

There are, indeed, several accidents to which mankind are exposed, which no human wisdom can foresee or prevent. Being furnished with faculties of a limited nature, and placed in the midst of a scene where so many powerful and complicated causes are in constant operation, we are sometimes exposed, all on a sudden, to the action of destructive causes, of which we were ignorant, or over which we have no control. Even although we could foresee a pestilence, a famine, an earthquake, an inundation, or the eruption of a volcano, we could not altogether prevent the calamities which generally flow from their destructive ravages. But, at the same time, it may be affirmed with truth, that a great proportion of the physical evils and accidents to which the human race is liable, are the effects of a culpable ignorance, and might be effectually prevented, were useful knowledge more extensively diffused. But it unfortunately happens, in almost every instance, that the persons who are exposed to the accidents to which I allude, are ignorant of the means requisite for averting the danger. To illustrate this point, I shall select a few examples, and shall intersperse a few hints and maxims for the consideration of those whom it may concern.

The first class of accidents to which I shall advert comprises those which have happened *from ignorance of the nature and properties of the different gases*, and of the noxious effects which some of them produce on the functions of animal life.

We have frequently read in newspapers and magazines, and some of us have witnessed such accidents as the following:—A man descends into a deep well, which had for some time been shut up. When he has gone down a considerable way he suddenly lets go his hold of the rope or ladder by which he descends, and drops to the bottom in a state of insensibility, devoid of utterance, and unable to point out the cause of his disaster. Another hastily follows him, to ascertain the cause, and to afford him assistance; but by the time he arrives at the same depth he shares the same fate. A third person, after some hesitation, descends with more cautious steps. But he soon begins to feel a certain degree of giddiness, and makes haste to ascend, or is drawn up by assistants. In the mean time, the unhappy persons at the bottom of the well are frequently left to remain so long in a state of suspended animation, that all means of restoration prove abortive; and the cause of the disaster remains a mystery, till some medical gentleman, or other person of intelligence, be made acquainted with the circumstances of the accident. Similar accidents, owing to the same cause, have happened to persons who have incautiously descended into brewers' vats, or who have entered precipitately into wine cellars, and vaults, which had been long shut up from the external air, and where the process of fermentation was going on: they have been suddenly struck down, as by a flash of lightning; and, in some instances, the vital spark has been completely extinguished. Many instances, too, could be produced of workmen who have incautiously laid themselves down to sleep in the neighbourhood of lime-kilns where they were employed, having, in a short time, slept the sleep of death. The burning of charcoal in close apartments has also proved fatal to many; more especially when they have retired to rest in such apartments, while the charcoal was burning, and before the rooms had received a thorough ventilation.

Numerous are the instances in which accidents have happened, in the circumstances now stated, and which are still frequently recurring; all which might have been prevented had the following facts been generally known and attended to:—That there exists a certain species of air, termed *fixed air*, or *carbonic acid gas*, which instantly extinguishes flame, and is destructive to animal life; that it is found in considerable quantities in places which have been shut up from the external atmosphere,—as in old wells, pits, caverns, and close vaults; that it is copiously produced during the fermentation of liquors in brewers' vats, where it hovers above the surface of the liquor; in cellars where wine and malt liquors are kept; and by the burning of lime and charcoal; and that, being nearly twice as heavy as common air, it sinks to the bottom of the place where it is produced. The following plain hints are therefore all that is requisite to be attended to, in order to prevent the recurrence of such disasters. Previous to entering a well or pit which has been long secluded from the external air, let a lighted candle or taper be sent down; if it continues to burn at the bottom there is no danger, for air that will support flame, without an explosion, will also support animal life; but, should the taper be extinguished before it reaches the bottom, it would be attended with imminent danger to venture down till the foul air be expelled. The noxious air may be destroyed by throwing down a quantity of *quick lime*, and gradually sprinkling it with water; for as the lime slakes it will absorb the mephitic air, and a person may afterward descend in safety. Where lime is not at hand, a bush, or such like bulky substance, may be let down and drawn up several times; or some buckets of water may be thrown into it, till the air be so purified that a lighted taper will continue to burn at the bottom. These precautionary hints will apply to all the other gases referred to, where this species of gas may happen to exist. To which I may also add, as another hint, that in every situation where fixed air is supposed to exist, it is more dangerous to sit or to lie down in such places, than to stand erect; for as this gas is the heaviest of all the gases, it occupies the lowest place; and therefore, a person lying on the ground may be suffocated by it, while another, standing at his side, would feel no injury, his mouth being raised above the stratum of the noxious fluid.* I shall only remark further on this head, that several disorders have been contracted by persons sleeping under the branches of trees in the night-time, and in apartments where great quantities of fruit, or other vegetable matter, are kept,—from ignorance of the fact, that during the night the leaves of trees, and all vegetable matter, perspire a deleterious air, which, when it has accumulated to a certain degree, may induce a variety of serious complaints, and sometimes prove fatal.

The disasters which have happened in coal mines, and other subterraneous apartments, form another class of accidents, many of which have been the effects of ignorance. Of late years an immense number of men, boys, and horses have been destroyed by the explosion of inflammable air in the coal mines in this country, particularly in the north of England, where the most affecting and tragical scenes have been presented to view. On the forenoon of Monday, 25th May, 1812, a dreadful accident took place at Felling, near Gateshead, in the mine belonging to C. T. Branding, Esq. When nearly the whole of the workmen were below,—the *second set* having gone down before the first had come up,—a double blast of hydrogen gas took place, and set the mine on fire, forcing up an immense volume of smoke, which darkened the air to a considerable distance, and scattered an immense quantity of small coal from the upcast shaft. In this calamity ninety-three men and boys perished. The mine was obliged to be closed up on the following

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* The grotto del Cani, a small cavern in Italy, about four leagues from Naples, contains a stratum of carbonic acid gas. It has been a common practice to drive dogs into the cavern, where they suffer a temporary death for the entertainment of strangers. But a man enters with perfect safety, and feels no particular inconvenience by *standing* in it, because his mouth is considerably above the surface of that stratum of deleterious air; but were he to lie down he would be instantly suffocated. The same precaution may also be useful in walking through certain caverns in our own country.

Saturday in order to extinguish the fire, which put an end to all hopes of saving any of the sufferers. On the 16th October, in the same year, and in the same county (Durham), a coal-pit at Shiney Row suddenly took fire by explosion of the inflammable air; in consequence of which seven persons were severely scorched. And on the Saturday following (October 10th), the Harrington Mill pit, distant from the other about two or three hundred yards, also took fire; by which four men and nineteen boys were killed on the spot, and many people severely wounded and burnt, and two boys were missing. This dreadful catastrophe was likewise occasioned by the explosion of fire damp.* The above are only two or three examples of a variety of similar accidents which have happened, of late years, in the coal districts in the northern parts of our island. That all such accidents could have been prevented by means of the knowledge we have hitherto acquired would perhaps be too presumptuous to affirm; but that a great proportion of them were the effects of ignorance on the part of the miners, and might have been prevented by a general knowledge of the nature and causes of such explosions, and by taking proper precautionary measures, there is every reason to believe. That this is not a mere random assertion will appear from the following extract from the Monthly Magazine, for February, 1814, p. 80:—"Mr. Bakewell, in his late lectures at Leeds, stated the following circumstance, which strongly evinces the benefits which arise from educating the working classes, that, in the coal districts of Northumberland and Durham, accidents are constantly taking place from explosions in the mines; so that not less than six hundred persons have been destroyed in the last two years. But, in one of the mines which was frequently subject to explosion, not an accident of any consequence had taken place for the last twelve years, the proprietors, besides other precautions, having for a considerable time past educated the children of the miners at their own expense, and *given them proper information respecting the nature of the danger to be avoided.*"†

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* See Monthly Magazine, vol. xxxiii. p. 580, and vol. xxxiv. p. 462.

† This section of the present work was written in 1816, and the facts referred to in it happened within three or four years of

Were the working miners carefully instructed in the nature and composition of the atmosphere, and its chymical properties, and particularly in the nature and composition of the different gases,—were such instructions illustrated by a judicious selection of chymical experiments, and were the proper practical hints and precautions deduced and clearly exhibited, there cannot be the least doubt that it would be attended with numerous beneficial results. When a person is ignorant of the noxious principles that may be secretly operating within the sphere of his labours, he will frequently rush heedlessly within the limits of danger; whereas, a man who is thoroughly acquainted with all the

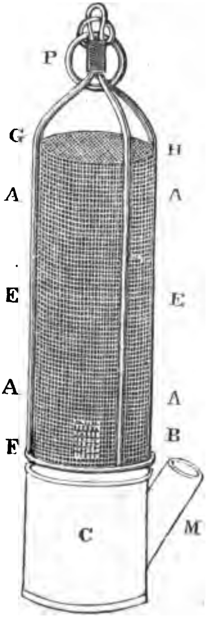
that date. Since that period Sir Humphrey Davy's ingenious contrivance, called the *Safety Lamp*, has been invented, by means of which, we have every reason to believe, many accidents in coal mines have been prevented, and many lives preserved from destruction. The peculiar property of this lamp is, that the miner may move about with it, and even work by its light in the midst of those explosive mixtures which have so often proved fatal when entered with a common lamp or a candle. It transmits its light, and is fed with air through a cylinder of copper wire-gauze. The *apertures* in the gauze are about one-twentieth or one-twenty-fifth of an inch square, and the *thickness* of the wire from one-fortieth to one-sixtieth of an inch in diameter. The parts of the lamp are:—1. The brass cistern which contains the oil. 2. The rim in which the wire-gauze cover is fixed, and which is fastened to the cistern by a moveable screw. 3. An aperture for supplying oil fitted with a screw or cork, and a central aperture for the wick. 4. The wire-gauze cylinder, which consists of at least 625 apertures to the square inch. 5. The second top three-fourths of an inch above the first, surmounted by a brass or copper plate, to which the ring of suspension is fixed. 6. Four or six thick vertical wires, joining the cistern below with the top plate, and serving as protecting pillars round the cage.

When the wire-gauze safety lamp is lighted and introduced into an atmosphere gradually mixed with fire-damp, the first effect of the fire-damp is to increase the length and size of the flame. When the inflammable gas forms one-twelfth of the volume of the air, the cylinder becomes filled with a feeble blue flame, but the flame of the wick appears burning brightly within the blue flame, and the light of the wick increases till the fire-damp increases to one-fifth, when it is lost in the flame of the fire-damp, which fills the cylinder with a pretty strong light. As long as any *explosive* mixture of gas exists in contact with the

variety of causes which may possibly be in action around him will proceed in every step with judgment and caution,

lamp, so long will it give its light, and when it is extinguished, which happens when the foul air constitutes one-third of the volume of the atmosphere, the air is no longer proper for respiration, for though animal life will continue where flame is extinguished, yet it is always with suffering.

DAVY'S SAFETY LAMP.



The following are the principal parts of the safety lamp:—F is the lamp, throwing up a brilliant flame. C is the reservoir, and, where danger is apparent, will hasten his retreat to a place of safety.

The injuries which are produced by the stroke of lightning form another class of accidents which are frequently owing to ignorance. It is still to be regretted, that, notwithstanding the discoveries of modern philosophy, respecting the electric fluid and the laws of its operation, no *thunder-guard* has yet been invented, which, in all situations, whether in the house, in the street, in the open field, in a carriage, or on horseback, shall serve as a complete protection from the ravages of lightning. Till some contrivance of this kind be effected, it is probable that the human race will still be occasionally subjected to accidents from electrical storms. Such accidents are more numerous and fatal, even in our temperate climate, than is generally imagined. From an induction of a variety of facts of this kind, as stated in the public papers and other periodical works, in the year 1811, the author ascertained that more than twenty persons were killed by lightning, during the summer months of that year, or at the rate of a thousand persons every fifty years, within the limits of our island; besides the violent shocks experienced by others, which did not immediately prove fatal, and the damage occasioned to sheep and cattle, and to public and private edifices; and it is worthy of notice, that most of the individuals who were killed by the lightning had either taken shelter under trees, or were in situations adjacent to bells or bell-wires. The experience of succeeding years proves that a similar number of disasters of this kind annually take place. It is, however, more than probable, that at least half the number of accidents arising from the same

supplied with oil by the tube M. EE is a frame of thick wire, to protect the wire-gauze, AAAA, which has a double top GH. The frame has a ring P attached to it, for the convenience of carrying it. The wire-gauze is well fastened to the rim B.

Notwithstanding the utility of this invention, such is the carelessness and apathy of the working miners, that they either neglect to use their safety lamps, or to attend to the means requisite to keep them in order,—which carelessness and apathy are the effects of that gross ignorance into which so many of them are sunk. Hence we find, that seldom a year passes in which we do not hear of destructive explosions happening in our coal mines, particularly in England.

cause might have been averted had the nature of lightning, and the laws which regulate its movements, been generally known. Seldom a year passes but we are informed by the public prints of some person or other having been killed by lightning, when taking shelter under a large tree,—of whole families having been struck down when crowding around a fireplace, during a thunder-storm,—of one person having been struck when standing beside a bell-wire, and another while standing under a bell connected with the wire, or under a lustre hanging from the ceiling.

There can be little doubt, that a considerable number of such accidents would have been prevented had the following facts respecting the nature of lightning been extensively known:—That lightning is a fluid of the same nature, and is directed in its motions by the same laws which regulate the motions of the electric fluid in our common electrical machines; that it is attracted and conducted by trees, water, moisture, flame, and all kinds of metallic substances; that it is most disposed to strike high and pointed objects; and that, therefore, it must be dangerous to remain connected with or in the immediate neighbourhood of such objects when a thunder-cloud is passing near the earth.

Hence the following precautionary maxims have been deduced, by attending to which the personal accidents arising from thunder-storms might be, in a great measure, prevented. In the open air during a storm, rivers, pools, and every mass of water, even the streamlets arising from a recent shower, should be avoided; because water, being an excellent conductor, might determine the course of an electrical discharge towards a person in contact with it, or in its immediate neighbourhood. All high trees and similar elevated conductors should also be avoided, as they are in more danger of being struck than objects on the ground; and, therefore, a person in contact with them exposes himself to imminent danger should the course of the lightning lie in that direction. But, to take our station at the distance of thirty or forty paces from such objects, or at such a distance as may prevent us from being injured by the splinters of wood, should the tree be struck, is more secure than even in the midst of an open plain. Persons in a house not provided with thunder-rods should avoid sitting near a chimney or fireplace, whether there be a fire in the grate or not. For when there is a fire in the grate the flue contains the following conductors,—flame, smoke, rarefied air, and soot. Even when there is no fire, the soot with which the flue is lined is a conductor; and from the superior height of the chimney-shaft above every other part of the building, it is more liable than any other part of the house to be struck with lightning. In a house, too, gilt mirrors or picture-frames, lustres or burning candles, bell-wires, and all metallic substances, should be carefully avoided, as they afford so many points of attraction, which might determine the course of an electric discharge. The safest position is in the middle of the room, if not near a lustre, a bell, or any thing hanging from the ceiling; and if we place the chair on which we sit on a bed or mattress, almost every possible danger may be avoided.* Such are a few maxims easy to be recollected and put in practice, by attending to which not a few accidents from electrical explosions might be averted.

In the next place, *various accidents have happened from ignorance of certain plain mechanical principles.* For example, serious accidents have sometimes occurred from the want of acquaintance with *the laws of motion.* Persons have heedlessly jumped out of moving vehicles, and got their legs and arms sprained or dislocated, and from one boat to another when both were in rapid motion, and run the risk of being either bruised, drenched, or drowned. But had the effects of *compound motion* been generally known and attended to, in all those cases where it occurs, it would have prevented many of those accidents which have happened from persons rashly jumping out of carriages when in rapid motion, or attempting to jump from the top of a moving cylinder, in which cases they are always precipitated with violence, in a direction different from what they expected, from the obvious effects of a combination of forces. Boats and carriages have been sometimes overset by persons rising hastily when they were in danger of such accidents,—from ignorance of the principle, that the centre of gravity of the moving vehicle, by such a practice, is raised so as to endanger the line of direction being thrown beyond the base, when the vehicle must, of course, be overturned; whereas had they clapped down to the bottom, they would have brought down the line of direction, and consequently the centre of gravity, farther within the base, so as to have prevented the accident and secured their safety. The reason of this will perhaps more plainly appear from the following explanations:—The *centre of gravity* is that point of a body about which all its parts are in *equilibrio*, or balance each other; and consequently, if this

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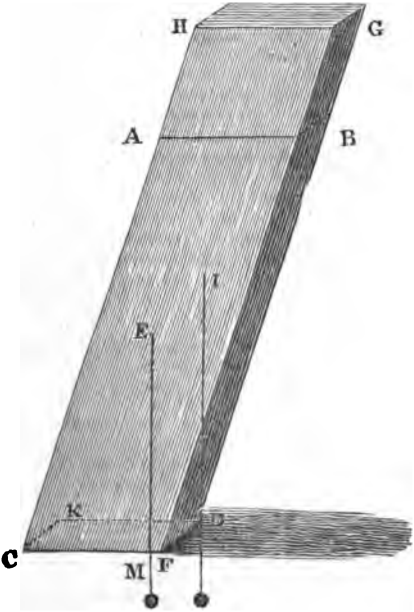
* It has been generally thought that the cellar is the most secure situation during a thunder-storm; but this is true only in certain cases. When the lightning proceeds from the clouds, it is unquestionably the most secure position; but in the case of *a returning stroke*, or when the lightning proceeds from the earth, it is less secure than the higher parts of the building.



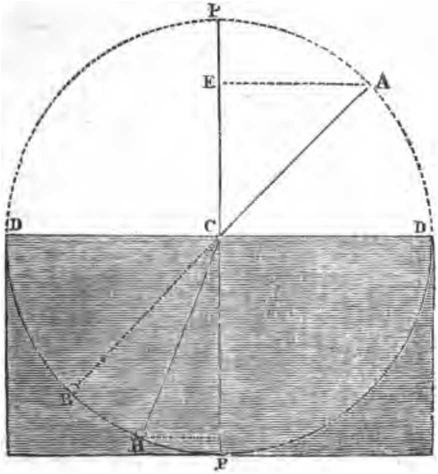
point be supported, the whole body will be at rest, and cannot fall. An imaginary line drawn from the centre of gravity of any body towards the centre of the earth is called *the line of direction*. Bodies stand with firmness upon their bases when this line falls *within* the base; but if the line of direction falls *without* the base, the body will be overturned. Thus, the inclining body ABCD, whose centre of gravity is E, stands firmly on its base CDKF, because the line of direction EM falls within the base. But if a weight, as ABGH, be laid upon the top of the body, the centre of gravity of the whole body and weight together, is raised up to I; and then, as the line of direction ID falls without the base at D, the centre of gravity I is not supported, and the whole body and weight must tumble down together.

The tower of Pisa, in Italy, leans sixteen feet out of the perpendicular, so that strangers are afraid to pass under it; but as the plummet or line of direction falls *within its base or foundation*, it is in no danger of falling, if its materials keep together; and hence it has stood in this state for three hundred years. But were an additional erection, of any considerable elevation, to be placed upon its top, it would undoubtedly soon tumble into ruins.

To a somewhat similar cause, in combination with heedlessness and ignorance, may be ascribed many of those accidents which so frequently happen at spinning mills and other pieces of machinery, by which legs and arms are torn asunder, and the human frame sometimes mangled and destroyed.

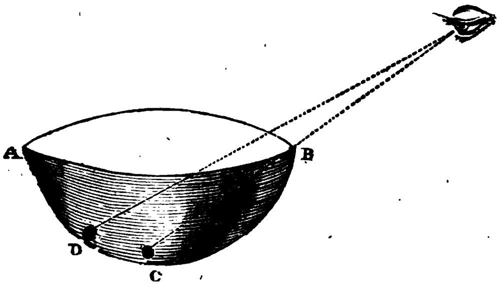
Fatal accidents have likewise happened *from ignorance of the effects produced by the refraction of light.* It is a well-known optical fact, that when a ray of light passes from air into water, and is again refracted, the sine of the angle of incidence is in proportion to the sine of the angle of refraction as four to three. From this circumstance it happens that pools and rivers appear shallower than they really are —their channels, when viewed from their brink, being apparently higher than their true position, in the proportion of three to four; so that a river eight feet deep will appear from its bank to be only six. This fact may be at any time perceived in a tub or pail full of water, where the bottom of the vessel will obviously appear to be raised a considerable space above its true position, and its apparent depth consequently diminished. In consequence of this optical illusion, which is not generally known, many a traveller, as well as many a schoolboy, has lost his life, by supposing the bottom of a clear river to be within his depth, as, when he stands on the bank, the bottom will appear one-fourth nearer the surface than it really is.

This will appear evident from the following illustrations:—If a ray of light AC passes obliquely from air into water,



instead of continuing its course in the direct line CB, it takes the direction CH, and approaches the perpendicular PP, in such a manner that the angle of refraction PCH is less than its angle of incidence, ECA. AE is the *sine* of the angle of incidence, and HP the sine of the angle of refraction; and the proportion they bear to each other is as four to three. If a small body, therefore, were placed at H and viewed from the point A, it would appear as if it were raised to the point B, or one-fourth higher than it really is.

This may be further illustrated by the following common experiment. Put a shilling into the bottom of an empty basin, at C, and walk backward till it appear completely hid by the interception of the edge of the basin; then cause water to be poured into the basin, and the shilling will instantly appear as if placed in the point D; for, being now in a denser medium, it appears raised, or nearer to its surface. Before the water was poured in, the shilling could not be seen *where it was;* now it is seen *where it is not.* It is not the eye that has changed its place, but the ray of light has taken a new direction, in passing from the water to the eye, and strikes the eye as if it came from the piece of money. This experiment may be varied as follows:—Take an empty basin, and along the diameter of its bottom fix marks at a small distance from each other, then take it into a dark room, and let in a ray of light; and where this falls upon the floor place the basin, so that its marked diameter may point towards the window, and so that the beam may fall on the mark most distant from the window. This done, fill the basin with water, and the beam, which before fell upon the most distant mark, will now, by the refractive power of the water, be turned out of its straight course, and will fall two or three or more marks nearer the centre of the basin.



It is owing to the circumstance now stated, that an oar partly in and partly out of water appears broken; that objects appear distorted when seen through a crooked pane of glass; that a fish in the water appears much nearer the surface than it actually is; and that a skilful marksman, in shooting at it, must aim considerably below the place which it seems to occupy. It is owing to the refractive power of the atmosphere that the sun is seen before he rises above the horizon in the morning, and after he sinks beneath it in the evening; that we sometimes see the moon, on her rising, totally eclipsed, while the sun is still seen in the opposite part of the horizon; and that the stars and planets are never seen in the places where they really are, except when they are in the zenith, or point directly over our head.

Many affecting and fatal accidents have happened, and are frequently recurring, particularly to children, and females in the higher ranks of life, *from their clothes catching fire*, most of which might be prevented, were the two following simple facts universally known and practically applied,—*that flame has a tendency to mount upwards*; and *that air is essentially requisite for supporting it.* When the clothes of females take fire, as the fire generally begins at the lower parts of their dress, so long as they continue in an upright posture, the flames, naturally ascending, and meeting with additional fuel as they rise, become more powerful in proportion; whereby the neck, the head, and other vital parts of the body are liable to be most injured; and, by running from one part of the room to another, or from one apartment to another, as is most frequently the case, the air, which is the fuel of fire, gains free access to every part of their apparel, and feeds the increasing flame. In such cases, the sufferer should instantly throw her clothes over her head, and roll or lie upon them, in order to prevent the ascent of the flames and the access of fresh air. When this cannot conveniently be effected, she may still avoid great agony, and save her life, by throwing herself at full length on the floor, and rolling herself thereon. Though this method may not, in every case, completely extinguish the flame, it will to a certainty retard its progress, and prevent fatal injury to the vital parts. When assistance is at hand, the bystanders should immediately wrap a carpet, a hearth-rug, a great-coat, or a blanket around the head and body of the sufferer, who should be laid in a recumbent position, which will prove a certain preventive from danger. During the year 1813, the author noted down more than ten instances, recorded in the public prints, of females who were burnt to death by their clothes catching fire, all of which might have been prevented, had the simple expedients now stated been resorted to, and promptly applied.

It may be remarked, in the next place, that *many of the diseases to which mankind are subject*—particularly fevers, small-pox, and other infectious disorders—might be prevented by the diffusion of knowledge in relation to their nature, their causes, and the means of prevention. It cannot have been overlooked, in the view of the intelligent observer, that fevers and other infectious disorders generally spread with the greatest facility and make the most dreadful havoc among the lower orders of society. This is owing, in part, to the dirty state in which their houses are kept, every part of which affords proper materials for the production and detention of pestilential effluvia, and their ignorance of the importance of pure atmospherical air to animal life, and the consequent necessity of daily ventilating their apartments. It is also owing in a great measure to the custom of persons crowding into the chambers of those who are labouring under such infectious diseases, and thereby not only increasing the strength of the infectious virus, but absorbing a portion of it in their own bodies, to spread its baleful influence in a wider circle. Such a conduct frequently proceeds from a want of conviction of the infectious nature of such disorders, and from ignorance of the rapid manner in which they are sometimes communicated from one to another, as well as from that obstinacy and from those inveterate prejudices which are always the accompaniments of ignorance. Though the *cow-pox* inoculation has been proved by experience to be an effectual preventive of that loathsome and often fatal disorder, the small-pox, yet numbers in the lower ranks of life cannot yet be persuaded to use this simple preventive, and will rather run the risk of experiencing all its disagreeable and dangerous effects both on their own persons and on those of their offspring. Their obstinate prejudices, in this and similar respects, are increased by their false views and reasonings respecting the doctrine of the Divine decrees, and the providence of the Almighty. They imagine, that to induce one species of disease for the prevention of another is attempting to take the government of the world out of the hands of the Creator, and that no means of preventing disorders can be of any avail, if the Deity has otherwise decreed; not considering that the Almighty governs the world he has created by regular and invariable laws, and accomplishes his decrees through the intervention of those secondary causes, both natural and moral, which are continually operating in the physical and intellectual world. Were general knowledge more extensively diffused, and the minds of the multitude habituated to just principles and modes of reasoning, such fallacious views and opinions would be speedily dissipated, and consequently those physical evils and disorders which they produce would be in a great measure prevented.

Again, to ignorance we must likewise attribute, in a great measure, *the pernicious effects of contaminated air in dwelling-houses.* Pure air is as essentially requisite to the health and vigour of the animal system as wholesome food and drink. When contaminated by stagnation, by breathing, by fires or candles, it operates as a slow poison, and gradually undermines the human constitution; yet nothing is less attended to in the economy of health by the great majority of mankind. Because air is an invisible substance, and makes little impression on the organs of sense, they seem to act as if it had no existence. Hence we find, that no attention is paid by the lower orders of society to the proper ventilation of their apartments. In some cases, the windows of their houses are so fixed in the walls as to be incapable of being opened; and in other cases, where the windows are moveable, they are seldom opened, except by accident, for weeks and months together; and were it not that a door and a chimney are to be found in every habitable apartment, the air would be rendered in many instances absolutely unfit for respiration. Crowds of tailors, weavers, shoemakers, and other mechanics, employed in sedentary occupations, are frequently pent up in close, and sometimes damp apartments, from morning till evening, without ever thinking of opening their windows for a single half-hour for the admission of fresh air; and consequently, are continually breathing an atmosphere highly impregnated with the noxious gas emitted from the lungs, and the effluvia perspired from their bodies, which is most sensibly felt by its hot, suffocating smell, when a person from the open air enters into such apartments. The sallow complexion of such persons plainly indicates the enervating effects produced by the air they breathe; and although its pernicious effects may not be sensibly felt, it gradually preys upon their constitutions, and often produces incurable asthmas, fevers, consumptions, and other dangerous disorders, which are frequently imputed to other causes. Nothing is more easy than to open the windows of an apartment, and other apertures that communicate with the external air, at meal hours, when the room is empty, in order to expel the contaminated air, and admit the pure vital fluid. No medicine or restorative is cheaper or of more importance to health and vigour than pure atmospherical air; yet, because it costs nothing, it is little regarded. Hints and admonitions in reference to this point are seldom attended to; for ignorance is always proud and obstinate, and the inconveniences supposed in certain cases to flow from the practice of ventilating particular apartments are seldom attempted to be remedied. It is, therefore, presumed, that were a knowledge of the nature of the atmosphere, of the ingredients that enter into its composition, of its indispensable necessity for the support and invigoration of animal life, of the circumstances by which it is deteriorated, and of the baneful effects which are produced by its contamination, more widely diffused, its use and importance would be more duly appreciated, and the disorders which flow from the circumstances now stated effectually prevented.*

Much benefit might also be produced, were *a knowledge of the means of restoring suspended animation*, in cases of drowning, strangulation, &c., generally disseminated. As prompt measures in such cases are absolutely necessary, many fatal effects have happened from the delay occasioned by medical assistance having been at a distance; which might have been prevented, had the proper means of resuscitation been known and immediately resorted to by the persons present at such a juncture. Were the nature and importance of the function of *perspiration* generally known and attended to, it might likewise be the means of preventing those diseases and disasters which flow from making sudden transitions from heat to cold, which are the origin of many fatal disorders among the labouring classes. If a man is thoroughly convinced that more than the one-half of what he eats and drinks is thrown off by insensible perspiration, he will at once see the importance of avoiding every practice and every circumstance which has a tendency to obstruct the operations of this important function.

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* The following fact shows, in an impressive manner, the danger arising from the want of a free circulation and frequent change of air. "In the lying-in hospital of Dublin, two thousand nine hundred and forty-four infants, out of seven thousand six hundred and fifty, died, in the year 1782, within the first fortnight from their birth. They almost all expired in convulsions; many foamed at the mouth; their thumbs were drawn into the palms of their hands; their jaws were locked; their faces swelled; and they presented, in a greater or less degree, every appearance of suffocation. This last circumstance at last produced an inquiry whether the rooms were not too close and insufficiently ventilated. The apartments of the hospital were rendered more airy; and the consequence has been, that the proportion of deaths, according to the registers of succeeding years, is diminished from *three* to *one*."

The last example I shall mention, though not of the least importance, is the fatal effects produced by ignorance of *the proper mode of treating children during the first stages of infancy*. It is a fact deduced from the annual registers of the dead, that one-half the number of children born die under seven years of age. This extraordinary mortality is universally imputed, by medical writers, to wrong management during the first and second years of their infancy, and the practice of giving anodyne aromatic medicines. Instead of clothing infants in such a manner as to give free scope for the exercise of all the vital functions as soon as they are ushered into the world, the midwives and officious matrons frequently vie with each other to improve upon nature by attempting to model the head and to strengthen the limbs by the application of fillets, rollers, and swaddling-bands of several yards in length; thus loading and binding them with clothes equal to their own weight to the manifest injury of the motions of their bowels, lungs, limbs, and other animal functions. Instead of covering the head with a thin single cap, and keeping the extremities in a moderate degree of warmth, an opposite course is most frequently pursued, which is supposed to be one among the many existing causes of hydrocephalus or water in the brain. Instead of allowing the first milk that is secreted, which nature has endowed with a purgative quality, to stimulate the bowels, it is a common practice, immediately on the birth of a child, to administer a variety of purgative medicines in close succession, "as if," says a modern writer, "to prove that it has arrived in a world of physic and of evils." Instead of being exposed to the invigorating effects of pure air, and kept in a moderate degree of temperature, they are too frequently confined to a hot contaminated atmosphere, which relaxes their solids, impedes their respiration, and frequently induces fatal convulsions.* These are but a few examples out of many which could be produced of the improper treatment of children, from which multitudes of painful complaints and dangerous disorders derive their origin. It is therefore reasonable to believe, that were general information on such topics extensively disseminated, and a more rational mode of nurture during the first years of infancy adopted, not only fatal disorders, but many subsequent diseases in life might either be wholly prevented, or, at least, greatly mitigated.

We have likewise reason to conclude, that a general dissemination of knowledge, by directing the mind to intellectual enjoyments, and lessening the desire for sensual pleasures, *would lead to habits of sobriety and temperance.* Intemperance has perhaps been productive of more diseases, misery, and fatal accidents than all the other causes I have now specified. It has benumbed the intellectual faculties, debased the affections, perverted the moral powers, degraded man below the level of the brutes, and has carried along with it a train of evils destructive to the happiness of families, and to the harmony and order of social life. Wherever intemperance prevails, a barrier is interposed to every attempt for raising man from the state of moral and intellectual degradation into which he has sunk, and for irradiating his mind with substantial knowledge. But were the mind in early life imbued with a relish for knowledge and mental enjoyments, it would tend to withdraw it from those degrading associations and pursuits which lead to gluttony, debauchery, and drunkenness, and consequently prevent those diseases, accidents, and miseries which invariably follow in their train. As the human mind is continually in quest of happiness of one description or another, so multitudes of the young and inexperienced have been led to devote themselves to the pursuit of sensual pleasures as their chief and ultimate object, because they have no conception of enjoyment from any other quarter, and are altogether ignorant of the refined gratification which flows from intellectual pursuits. In the prosecution of knowledge the rational faculties are brought into exercise, and sharpened and invigorated; and when reason begins to hold the ascendency over the desires and affections, there is less danger to be apprehended that the mind will ever be completely subjected to the control of the sensitive appetites of our nature.

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* See the preceding note, p. 65.

I might also have stated, that many physical evils might be prevented, were mankind at large acquainted with the characteristics of poisonous plants; the means of detecting mineral poisons, and the mode of counteracting their effects; the proper mode of extinguishing fires, and of effecting an escape, in cases of danger, from that element; *the precautions requisite to be attended to in the management of steam-engines*,* &c. &c. But, as a minute acquaintance with some of these subjects supposes a greater degree of knowledge than could reasonably be expected in the general mass of society, I shall not further enlarge. The few examples I have selected will, it is presumed, be sufficient to prove and illustrate the position stated in the beginning of this section, "that knowledge would, in many cases, prevent dangers, diseases, and fatal accidents." If it be admitted that several hundreds of persons are annually destroyed by noxious gases, by the explosions of fire-damp in coal-mines, by the stroke of lightning, by their clothes catching fire, and other accidents; and that several thousands are, during the same period, carried off by infectious diseases, and by those diseases which are the effects of contaminated air, and an improper mode of treatment during the first stages of infancy; and if a general diffusion of knowledge respecting the principles and facts adverted to above would have a tendency to prevent one-half the number of such physical evils as now happen, it will follow that several hundreds, if not thousands, of useful lives might annually be preserved to the community, and a great proportion of human suffering prevented; and if so, the cause of humanity, as well as of science, is deeply interested in the general diffusion of useful knowledge among persons of every nation, and of every rank.

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* See Appendix, No. VIII.

In the conclusion of this topic it may be remarked, that the knowledge requisite for the purpose now specified is of easy acquisition. It requires no peculiar strength or superiority of genius, nor long and intricate trains of abstract reasoning; but is capable of being acquired by any person possessed of common sense when his attention is once thoroughly directed to its acquisition. As the food of the body which is the most salutary and nourishing is the most easily procured, so that kind of knowledge which is the most beneficial to mankind at large is, in general, the most easily acquired. Its acquisition would not in the least interfere with the performance of their regular avocations, as it could all be acquired at leisure hours. It would habituate them to rational reflections and trains of thought, and gradually unfold to their view new and interesting objects of contemplation. It would have a tendency to prevent them from spending their hours of leisure in folly or dissipation, and would form an agreeable relaxation from the severer duties of active life.

SECTION III.

On the Influence which a General Diffusion of Knowledge would have on the Progress of General Science.

We have already seen that the diffusion of knowledge among the general mass of society would eradicate those false and superstitious opinions which have so long degraded the human intellect; would introduce just conceptions of the attributes of the Deity, and of his operations in the system of nature; and would avert, or, at least, greatly mitigate, many of those physical evils to which the human race has been subjected. Although these were the only advantages to be derived from the general dissemination of knowledge, they would be sufficient to warrant every exertion which the friends of science and of humanity can make to accomplish such an important object. But these are only a few of the many beneficial results which would, doubtless, flow from the progress of rational investigations and scientific pursuits. Knowledge, in its progress through the general mass of society, and among the various tribes of mankind, could not long remain confined within its present boundaries, but would, in all probability, enlarge its circumference nearly in proportion to the extent of its diffusion. The man of erudition and of science, who now exerts his influence and his talents to enlighten the minds of his fellow-men, would be laying a foundation for the expansion of his own intellectual views, and of those of his successors in the same pursuits in future generations. As a small body of snow, by rolling, gradually accumulates to a large mass, so that portion of knowledge we already possess, in its progress through the various ranks of mankind, would have its volume increased, and its present boundaries extended, so that new scenes of intellectual vision and enjoyment would be continually opening to the view. In accordance with these views, I shall now proceed to illustrate the position,

That *a general diffusion of knowledge would tend to the rapid advancement of universal science.*

We are placed in the midst of a scene where a vast multiplicity of objects solicit our attention. Whether we look around on the surface of the earth, or penetrate into its bowels, or turn our eyes upwards to the surrounding atmosphere and the vault of heaven, we perceive an immense variety of beings, celestial and terrestrial, animated and inanimated, continually varying their aspects and positions, all differing from each other in certain points of view, yet connected together by various relations and resemblances.

Science, in the most general and extensive sense of the term, consists in a perception of the resemblances and differences, or the relations which these objects have to one another, and to us as rational beings. To ascertain the almost infinite number of relations which subsist among the immense variety of objects which compose the material and intellectual universe, requires an immense multitude of observations, comparisons, and deductions to be made by a vast number of observers placed in various circumstances and positions; or, in other words, *the discovery of an immense number of facts*. All science may therefore be considered as founded on *facts;* and perhaps there would be few exceptions to the truth of the position, were we to assert, that the most sublime truths and deductions, in every science, when stripped of all their adventitious circumstances, simplified, and expressed in the plainest and most perspicuous terms, may be reduced to so many facts. This position might be illustrated, were it necessary, by an induction of particulars from the various branches of mathematical and physical science. That "a whole is greater than any of its parts,"—that "the square described on the hypothenuse of a right-angled triangle is equal to the sum of the squares described on its remaining sides," are facts, the one deduced from observation or simple intuition, the other from a series of comparisons. That the sun is the centre around which the planetary bodies revolve,—that a projectile describes a parabolic curve,—that the velocities of falling bodies are in proportion to the spaces run over,—that fluids press in all directions,—that the pressure of the atmosphere will support a column of water to the height of above thirty feet,—that the elastic spring of the air is equivalent to the force which compresses it,—that the angle of incidence of a ray of light is equal to the angle of reflection,—that the north pole of one magnet will attract the south pole of another,—that the air we breathe is a composition of oxygen and nitrogen,—and a variety of similar truths,—are *facts*, deduced either from simple observation and experiment, or from a comparison of a series of phenomena and experiments with each other. Now, every comparison we make between two or more objects or ideas, is an act of the mind affirming a resemblance, or a disagreement between the objects compared; which affirmation, if deduced from a clear view of the objects presented to the mind or senses, is the declaration of a fact.

If the above sentiments are just, it will follow, that every person possessed of an ordinary share of understanding, and whose organs of sensation are in a sound state, is capable of acquiring all the leading truths of the most useful sciences, since he enjoys the senses and faculties requisite for the observation of facts, and for comparing them with one another. And if such a person is capable of receiving into his mind truths already ascertained, he is also, for the same reason, qualified for discovering new truths or facts, provided he be placed in such circumstances as shall have a tendency to present the objects of his pursuit in the clearest point of view, that he have an opportunity of surveying them on all sides, and that his attention be firmly riveted on their several aspects and relations. That one man, therefore, excels another in these respects, is chiefly owing to his mind being more particularly directed to the contemplation of certain objects and relations, and his mental faculties concentrated upon them. When a person devoted to scientific investigation discovers a new fact, it is not, in the majority of instances, because he possesses powers of intellect and organs of sensation superior to the ordinary endowments of humanity, but because he was placed in different circumstances, and had his attention directed to different objects, and was thus enabled to perceive relations and combinations which had been either unnoticed by others, or which were placed beyond the range of their observation. *Genius*, then, which is generally attributed to such characters, may be considered as consisting in a concentration of the rays of intellect upon any particular object, art, or science, arising from a lively taste we feel for that particular study. It may be compared to a *burning lens*, where the scattered rays of light are rendered powerful by being collected into a point.

In so far, then, as we are able to direct the faculties of the mind—however moderate a degree of vigour they may possess—to the fixed contemplation of scientific objects, in so far may we expect that new relations will be discovered and new truths elicited. Sir Isaac Newton was one day asked, "How he had discovered the true system of the universe?" He replied, "By continually thinking upon it." He was frequently heard to declare, that "if he had done the world any services, it was due to nothing but *industry and patient thought*, that he kept the subject under consideration constantly before him, and waited till the first dawning opened gradually, by little and little, into a full and clear light." Had this illustrious philosopher been born of barbarous parents in the wilds of Africa, had he been placed in circumstances widely different from those in which he actually existed, or had not his attention, by some casual occurrence, been directed to the grand object which he accomplished, in all probability his mind would never have ranged through the celestial regions, nor have discovered the laws of the planetary motions.

Many important scientific facts require only a certain combination of circumstances to bring them to the view of any common observer. To discover the phases of the planet Venus, the satellites of Jupiter, and the elliptical figure of Saturn, after the telescope was invented, required no uncommon powers either of vision or of intellect in Galileo, who first brought these facts to view, however superior the faculties he actually possessed. It only required that he had a previous knowledge of the existence of these planetary bodies, that his mind was interested in the extension of science, and that he foresaw a probability that new and interesting facts might be discovered by directing his newly invented instrument to the starry regions. And when once he had descried from his observatory such new celestial wonders, every other person whose organs of vision were not impaired, with a similar tube, might discover the same objects. Yet, for want of the qualifications which Galileo possessed, the telescope might have long remained in the hands of thousands before such discoveries had been made; and it is a fact, that though the telescope was in use a considerable time before Galileo made his discoveries, no person had previously thought of directing it to the planets; at any rate, no discoveries had been made by it in the heavens.

The discovery of new truths in the sciences, therefore, is not, in most instances, to be ascribed to the exertions of extraordinary powers of intellect; but, in a great majority of cases, to the peculiar series of events that may occur in the case of certain individuals, to the various circumstances and situations in which they may be placed, to the different aspects in which certain objects may be presented to their view, and sometimes to certain casual hints or occurrences which directed their attention to particular objects. A spectacle-maker's boy, by an accidental experiment, led to the invention of the telescope; the remark of a fountain-player, who observed that water could rise only to thirty-two feet in the tubes of a forcing engine, led Galileo to calculate the gravity of the air. Newton's attention was first directed to a profound research into the laws of falling bodies, by the circumstance of an apple falling upon his head, as he was sitting under a tree in his garden, which led to the discovery of the grand principle which unites the great bodies of the universe. The well-known Mr. James Ferguson, author of several popular treatises on astronomy and mechanical philosophy, invented a system of mechanics, and ascertained the laws of the different mechanical powers, when only eight years of age, and before he knew that any treatise had ever been written on that subject. The accidental circumstance of seeing his father lift up the roof of his cottage, by means of a prop and lever, first directed his mind to these subjects, in which he afterward made many useful improvements.

If, then, it be admitted, that an extraordinary degree of intellectual energy and acumen is not necessary, in every instance, for making useful discoveries,—that the concentration of the mental faculties on particular objects, and the various circumstances in which individuals may be placed, have led to the discovery of important facts,—it will follow, that the exertion of the ordinary powers of intellect possessed by the mass of society is sufficient for the purpose of prosecuting scientific discoveries, and that the more the number of scientific observers and experimenters is increased among the inferior ranks of society, the more extensively will interesting facts and analogies be ascertained, from which new and important principles of science may be deduced.

An ample field still remains for the exertion of all the energies of the human mind. The sciences are, as yet, far removed from perfection; some of them have but lately commenced their progress, and some of their elementary principles still require to be established by future observations. The objects of nature which science embraces are almost infinite; the existence of many of these objects has not yet been discovered, and much less their multiplied relations and combinations. The researches of ages are still requisite, in order thoroughly to explore the universe, and bring to view its hidden wonders. In order to bring to light, as speedily as possible, the undiscovered truths of science, we must endeavour to increase the number of those who shall devote themselves, either wholly or in part, to scientific investigation and research. And were this object attained, in all probability the number of useful truths and facts which would be discovered would be nearly in proportion to the number of those whose attention is directed to such researches.

This might be illustrated from the history of the past progress of science. In those ages when only a few solitary individuals, here and there, directed their attention to such pursuits, little or no progress was made in the various departments of human knowledge; nay, sometimes they appeared to have taken a retrograde course. During the dark ages, when the human mind, fettered by papal tyranny and superstition, and absorbed in sensual gratifications, seldom made excursions into the regions of science, no useful discoveries were brought to light,—science was not only at a stand, but the knowledge and improvements of preceding ages were even in danger of being entirely obliterated. But no sooner had the human intellect burst its fetters, and the number of rational investigators begun to increase,—no sooner had they formed themselves into regular associations for scientific purposes, than Science and Art were aroused from the slumber of ages, and began to move forward towards perfection with accelerated progress. This may easily be traced by those who have attended to the history of science during the last 160 years. About the commencement of this period, the Academy of Sciences at Paris and the Royal Society of London were established. These soon gave birth to similar societies in almost every country in Europe; and there can be no doubt that the advanced state of knowledge in the present day is chiefly to be attributed to the investigations and discoveries made by the members of those associations, to their joint co-operation in the propagation of useful knowledge, and to the stimulus they afforded to intellectual pursuits.

Would we then accelerate the march of science far beyond the rate of its past and present progress,—would we wish to extend its range far beyond its present boundaries, —nothing is so likely to effectuate this end, as an increase of the number of scientific experimenters and observers. Let a certain portion of rational information be imparted to the great mass of mankind,—let intellectual acquirements be exhibited to them as the noblest objects of pursuit, and let them be encouraged to form associations for the purpose of mutual improvement and scientific research. By these means their attention would be directed to intellectual improvement, a taste would be excited for rational investigations, which would stimulate them to make further progress; they would soon feel an interest in the objects of science, they would listen with pleasure to the accounts of discoveries which are gradually brought to light throughout the different regions of physical investigation; and would be stimulated, from a laudable ambition of distinguishing themselves as discoverers, as well as from an innate love to the pursuit of knowledge, to observe those facts, to make those researches, and to institute those experiments that might have a tendency to enlarge the circle of human knowledge. Were the number of such persons increased but a thousand-fold, so that for every twenty scientific investigators now existing, twenty thousand were employed in surveying the various localities, aspects, and operations of nature, in the animal, vegetable, and mineral kingdoms, on the surface of the earth and the ocean, and in the celestial regions,—*hundreds* of new facts would, in all probability, be brought to light, for *one* that is now discovered by the present contracted circle of scientific men, from which new and important conclusions in the arts and sciences might be deduced.

Nor let it be objected that the great bulk of mankind, particularly the middling and lower ranks of society, are incapable of making any important discoveries in science. If what we have already stated be correct, they are possessed of all the essential requisites, not only for acquiring the elementary principles of knowledge, but also for penetrating beyond the circle which marks the present boundaries of science. They are all organized in nearly the same manner (a few insulated individuals only excepted), and, consequently, have nearly an equal aptitude for the exercise of conception, judgment, and ratiocination. They have the same organs of sensation, and the same powers of intellect, as persons in the highest ranks of society. The grand scene of the universe is equally open to peasants and mechanics as to princes and legislators; and they have the same opportunities of making observations on the phenomena of nature and the processes of art,—nay, in many instances, their particular situations and modes of life afford them peculiar advantages in these respects which are not enjoyed by persons of a superior rank. In short, they have the same innate curiosity and taste for relishing such investigations, provided the path of knowledge be smoothed before them, and their attention thoroughly directed to intellectual acquisitions.

Nor, again, should it be objected that an attention to such objects, and an exquisite relish for mental enjoyments, would unfit them for the ordinary duties of active life. Every man, under a well-regulated government, enjoys a certain portion of leisure from the duties of his station, which in too many instances is wasted either in listless inaction, or in the pursuits of folly and dissipation. This leisure is all that is requisite for the purpose in view. It would only be requisite that, during its continuance, the train of their thoughts should be directed into a channel which would lead them to more pleasing associations, and more substantial pleasures, than the general current of human thought is calculated to produce. That those who are in the habit of exercising their faculties on rational subjects are thereby rendered more unfit for the common business of life, it would be absurd to suppose. He who habitually exercises his judgment on scientific objects is gradually improving his mental powers, and must, from this very circumstance, be better qualified than others for exercising them in his particular trade or profession. For the habit of exerting the intellectual faculties in any one department must necessarily fit them for vigorous exertion on any other object, whether mechanical, agricultural, social, or domestic, to which the attention may be directed. The evils which at present derange the harmony of society, so far from arising from a vigorous exertion of intellect, are to be ascribed, for the most part, to an opposite cause. The intellectual powers, in the case of the great bulk of mankind, lie in a great measure dormant, their energies are not sufficiently exerted in any department of active life; and when occasionally roused from their inactivity, they are too frequently exercised in the arts of deception, of mischief, and of human destruction. To direct the current of human thought, therefore, into a different channel, besides its influence on the progress of science, would be productive of many happy effects on the social and moral condition of mankind; and as far as my experience goes, with a very few exceptions, I have found, that those who are addicted to rational pursuits are the most industrious and respectable members of civil and Christian society.

The above hints have been thrown out with the intention of showing, that, as all science is founded on facts, and as every person possessed of the common organization of human nature is capable of observing facts, and of comparing them with one another,—as the discovery of new truths is owing more to the concentration of the mental faculties on particular objects, and to several accidental circumstances, than to the exertion of extraordinary powers of intellect,—and as the sciences have generally improved in proportion to the *number* of those who have devoted themselves to their cultivation,—so there is every reason to conclude, that the diffusion of general knowledge and of a scientific taste, and, consequently, the increase of scientific observers, would ensure the rapid advancement of the different sciences, by an increase of the facts in relation to them which would thus be discovered.

I shall now endeavour to illustrate the positions stated above, by a few examples in relation to two or three of the physical sciences.

Geology.—This science is yet in its infancy; and some of its first principles require to be confirmed and illustrated by an induction of an immense number of facts of various descriptions. It is a branch of knowledge altogether founded upon facts palpable to the eye of every common observer. Its object is, to investigate the internal structure of the earth, —the arrangement of its component parts,—the changes which its materials have undergone since its original formation,—and the causes which have operated in the production of these changes. To determine such objects, it is requisite that an immense variety of observations be made on the form, position, and arrangement of mountains,—on the beds of rivers,—the interior of caverns,—the recesses of ravines,— the subterraneous apartments of mines,—the fissures and chasms which abound in alpine districts,—and even on the bottom of the ocean, in so far as it can be explored; and that a multitude of facts be collected in relation to the materials and position, the elevation and inflection, the fraction and dislocation of the earth's strata—calcareous petrifactions—metallic veins—decomposed rocks—mosses—rivers—lakes—sand-banks—seacoasts—the products of volcanoes—the composition of stone, sand, and gravel—the organic remains of animal and vegetable matter,—in short, that the whole surface of the terraqueous globe, and its interior recesses, be contemplated in every variety of aspect presented to the view of man. The observations hitherto made in reference to such multifarious objects have been chiefly confined to a few regions of the earth, and the facts which have been ascertained with any degree of precision, have been collected chiefly by a few individuals, within the last fifty or sixty years. From such partial and limited researches general principles have been deduced, and theories of the earth have been framed, which could only be warranted by a thorough examination of every region of the globe. Hence one theory of the earth has successively supplanted another for more than a century past. The theories of Burnet, Whiston, Woodward, Buffon, and Whitehurst have each had its day and its admirers, but all of them are now fast sinking into oblivion, and in the next age will be viewed only as so many philosophical rhapsodies, and ingenious fictions of the imagination, which have no solid foundation in the actual structure of the earth. Even the foundations of the Huttonian and Wernerian systems, which have chiefly occupied the attention of geologists during the last thirty years, are now beginning to be shaken, and new systems are constructing composed of the fragments of both. One principal reason of this diversity of opinion respecting the true theory of the earth undoubtedly is, that all the facts in relation to the external and internal structure of our globe have never yet been thoroughly explored. Instead of retiring to the closet, and attempting to patch up a theory with scattered and disjointed fragments, our province, in the mean time, is to stand in the attitude of surveyors and observers, to contemplate every aspect which terrestrial nature presents, to collect the minutest facts which relate to the object in view, and then leave to succeeding generations the task of constructing a theory from the materials we thus prepare.

Were we now to suppose, that, instead of one observer of geological facts that now exists, thousands were distributed throughout the different continents and islands, having their minds occasionally directed to such investigations; that the miners and labourers in coal-pits, iron-mines, and quarries, not only in Europe, but throughout Mexico and Peru, in the East and West Indies, in Canada, in New-Holland, in Southern Africa, in the ranges of the Alps, the Andes, the Himalayas, and other quarters, observed with attention the various phenomena of nature subject to their inspection, with this object in view; that sailors, missionaries, and travellers of every description contemplated the different aspects of nature in the regions through which they passed, and recorded the facts which came under their observation, for a similar purpose; and could we still further suppose that the great body of mankind in every clime might, at no distant period, have their minds directed to similar subjects, there cannot be the least doubt but an immense multitude of important facts would soon be accumulated, which would throw a striking light on the constitution of our planetary globe, and on the changes and revolutions through which it has passed, which would form a broad basis for the erection of a true theory of the earth, and tend either to establish or to overthrow the hypotheses which have hitherto been framed. Persons in the lower spheres of life have, in many cases, more frequent opportunities of ascertaining facts of the description to which I allude than many others who are placed in an elevated rank. Colliers, quarriers, miners of every description, and the inhabitants of alpine districts, are almost daily in contact with objects connected with geological research; and it is only requisite that their attention be directed to such inquiries—that the knowledge of a few elementary terms and principles be imparted to them—that they be directed to classify the facts which fall under their observation—and that a systematic list of queries, such as those published some years ago by the London "Geological Society," be put into their hands.*

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* The queries to which I refer may be seen in the "Monthly Magazine" for June, 1817, p. 436-439. A few years ago, some interesting fossil remains, supposed to be the teeth and other bones of the extinct animal designated by the name of *Mammoth*,

Natural History.—It is evident that the extension and improvement of this department of knowledge depends almost entirely on observation. Although a considerable accession has of late years been made to our knowledge in this branch of study, yet much still remains to be accomplished before all the objects it embraces be thoroughly explored. Our acquaintance with the zoology, botany, and mineralogy of New-Holland, Polynesia, Birmah, China, Tartary, Tibet, Africa, and America is extremely limited; and even within the limits of Europe, numerous unexplored regions still lie open to the future researches of the natural historian. So numerous are the objects and investigations which natural history presents, that although its cultivators were increased ten thousand fold, they would find sufficient employment in the prosecution of new discoveries for many centuries to come. Even those minute objects, in the animal and vegetable kingdoms, which lie beyond the natural sphere of human vision, and which the microscope alone can discover, would afford scope for the investigations of thousands of ingenious inquirers, during an indefinite series of ages. And it ought never to be forgotten, that every new object and process we are enabled to trace in this boundless field of observation presents to us the Deity in a *new aspect*, and enables us to form more enlarged conceptions of that power and intelligence which produced the immense assemblage of beings with which we are surrounded.

were almost entirely destroyed through the ignorance of some labourers in the parish of Horley, who happened to hit upon them when digging gravel, After cleaving them to pieces with their pick-axes, and finding it added nothing to their store of knowledge, "they threw away the fragments among the heaps of gravel, and the subject was consigned to oblivion; and it was only by accident that two entire teeth were found by a gentleman in the neighbourhood. The bones supposed to have been either destroyed or lost are a very large bone, supposed to have been a thigh-bone, a huge blade-bone, and a tusk of ivory, perfect in its form, described as being about half a rod in length." Had these labourers been aware of the interesting nature of such fossils, they might have been all preserved entire; and this circumstance shows how important such occurrences, and the observations and researches of common labourers, might sometimes prove to the geologist and the general student of nature.

Independently of the additions that might be made to our knowledge of animals, vegetables, and minerals, there are several facts in natural history which might be more precisely ascertained and explained, were common labourers and others in the same rank of life inspired with the spirit of philosophical observation. For the illustration of this, I shall state only one particular circumstance. It is a fact, which, however inexplicable, must be admitted, that *toads* have been found alive in the heart of solid rocks, and in the trunks of trees, where they have been supposed to have existed for ages without any apparent access to nourishment or to air. Such facts are supported by so numerous and so respectable authorities, that it would be vain to call in question their reality; and they assume a more mysterious aspect, from the circumstance, that toads, when placed in the exhausted receiver of an air-pump, like all other animals, soon lose their existence. That the toad is not the only animal which has been found in similar instances appears from a notice in the Monthly Magazine for April, 1817, which states, that "a large lizard or serpent was found by some miners, imbedded in a stratum of mineral substance, and lived for some time after it was extricated." As the mineral substance in which this animal was found was at the bottom of a deep mine, and connected with the surrounding strata, we are almost under the necessity of concluding that it must have existed in that state for many years. Now, it is proper to take into consideration, that such facts have been discovered, in the first instance, by labourers, quarriers, miners, and others engaged in laborious occupations, who, with the limited knowledge they at present possess, are unqualified for attending to all the circumstances which require to be noticed in conducting philosophical researches. Were persons of this description accustomed to examine every uncommon occurrence of this kind with a philosophic eye; were they, in such cases as those to which I have now referred, to examine, with accuracy, whether chinks or fissures, either horizontal or perpendicular, existed in the rocks, or were connected with the holes or vacuities of the old trees, where toads were found alive; and were every other circumstance which a scientific investigator would take into account accurately observed and recorded, such observations might ultimately lead to some rational explanations of such unaccountable facts. At any rate, as those who belong to that class of society to which I allude have many opportunities of contemplating the various objects and operations of the material world, their accumulated observations, when scientifically directed, could not fail of enlarging our knowledge of facts in several departments of the history of nature.

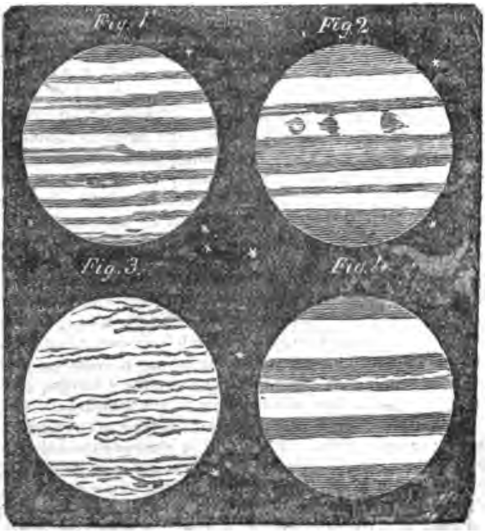
Meteorology.—In this department of physical science, numerous facts still remain to be ascertained, before we can attempt to explain the causes of various interesting phenomena. We have hitherto been unable to collect with precision all the facts in relation to the diversified phenomena of the atmosphere, and are still at a loss to explain, on known principles, the causes which operate in producing many atmospherical appearances. We are still in a great measure ignorant of the *aurora borealis*, with respect to its nature and origin, its distance from the surface of the earth, what precise connexion it has with the magnetic and electric fluids, and why it has been frequently seen at some periods, and been invisible at others. We are in a similar state of ignorance in regard to *luminous and fiery meteors*,—as to their different species and varieties, the velocity and direction of their motions, their influence on other atmospherical phenomena, on vegetation, and on the weather, and the principles in nature which operate in their production. Although the general cause of *thunder-storms* is in some measure ascertained, yet we are ignorant of the causes of a variety of phenomena with which they are sometimes accompanied, and of some of the chymical agents by which they are produced. To determine the origin of *meteoric stones*, the particular regions in which they are produced, the causes of their extreme velocity, the oblique direction of their motion, and the agents which concur in their formation, has hitherto baffled the researches of the whole philosophical world. Even the nature of *the clouds*, their various modifications, their different electric states, the causes which combine to produce their precipitation into rain, the nature of evaporation, together with an immense number of facts requisite for laying the foundation of a correct theory of the weather, are still hid in obscurity.

It is obvious, that a thorough knowledge of atmospherical phenomena cannot be acquired, before we have ascertained, not only the particular facts and appearances connected with the atmosphere, but all the preceding, concomitant, and consequent circumstances with which they are generally accompanied; and to determine such particulars requires an immense variety of observations, both by day and by night, through all the regions of the earth. Before such facts be more fully ascertained, our attempts to account for various atmospherical phenomena must prove unsatisfactory and abortive. Hence, the causes assigned by philosophers of the last century for the production of rain, hail, dew, fire-balls, and other meteors are now considered nugatory and erroneous; and few will be bold enough to maintain that we have yet arrived at the knowledge of the true causes. If these sentiments be admitted, it will follow, that an increased number of observers of the scenery of the atmosphere, in different climates, with a scientific object in view, could not fail of increasing our knowledge both of the phenomena which take place in the regions of the atmosphere, and of the powers of nature which operate in their production.

With respect to the *auroræ boreales*, some data might be ascertained for determining their height above the surface of the earth, which might lead to a discovery of their true cause, were a multitude of observers, in different places, at the same moment, to take the altitude and bearing of any particular coruscation, particularly of the modification of this phenomenon, which assumes the form of a rainbow or luminous arch, which can instantly be done by noting the series of stars which appear about the middle or sides of the arc at any particular instant. By this means the parallactic angle might be found, and the distances of the places of observation, or their difference of latitude, if directly north and south of each other, would form base lines for determining the perpendicular elevation of the phenomenon. In reference to luminous meteors, as they are most frequently seen in the night-time, men of science and persons of elevated rank have seldom opportunities of observing their diversified phenomena, and the circumstances with which they are preceded and accompanied. But while persons of this class are reclining on beds of down, or regaling themselves at the festive board, hemmed in from the view of the surrounding sky by the walls and curtains of their splendid apartments, many in the lower walks of life are "keeping watch by night," or travelling from place to place, who have thus an opportunity of observing every variety of atmospherical phenomena; and it is not unlikely may have seen several species of luminous and fiery meteors unknown to the scientific world. Were persons of this description, particularly watchmen, soldiers, sailors, mail-coach guards, policemen, and such like, capable of observing such appearances with scientific interest and accuracy, and of recording their observations, various important additions might be made to the facts which compose the natural history of the atmosphere.

Similar additions might be made to our knowledge of thunder-storms, were their phenomena and concomitant circumstances accurately noted by a vast number of persons in different places. It might, for example, be determined, from a multitude of observations made with this special object in view, at what distance from the earth a thunder-cloud may explode without danger,—in what circumstances, and at what elevation it generally attains its striking distance, and brings us within the range of its destructive influence,—what particular effects, hitherto unobserved, are produced by lightning on animal, vegetable, and mineral substances,—to what practical purposes its agency might be applied,—and how its destructive ravages might be averted or diminished. The same remarks will apply to the singular phenomenon of meteoric stones. These have seldom been observed at the instant of their descent by men addicted to philosophical research; but chiefly by peasants, labourers, and mechanics, who, at present, are generally unqualified for attending to every circumstance in the preceding and concomitant phenomena connected with their descent, with the discerning eye of a philosopher; and, therefore, we may still be ignorant of certain important facts in the history of the fall of these bodies, which may long prevent us from forming any rational theory to explain their causes, or to determine the regions whence their origin is derived.

Astronomy.—My next illustration shall be taken from the science of astronomy. Though this is among the oldest of the sciences, and its general principles are established with greater precision than those of almost any other department of science, yet many *desiderata* requisite to its perfection, still remain to be ascertained. The late discovery of several new planets, both primary and secondary, leads us to conclude that other globes of a similar nature, belonging to our system, may still lie hid in the distant spaces of the firmament. The spheroidal figure of some of the planets—their periods of rotation—the nature of the changes which appear to take place on their surfaces or in their atmospheres—the precise nature of the solar spots, the causes of their changes, and the influence which those changes produce on our earth or atmosphere—the parallax of the fixed stars—the rate of motion of the planetary system in absolute space—the gradual formation of nebulæ—the nature of variable stars—the number of comets, their periods, the nature of their tails and atmospheres, and their uses in the system of nature—with many other interesting particulars of a similar description, still remain to be ascertained. To



determine such objects requires a multiplicity of long-continued observations in every region of the heavens; and, it must be evident that the more we increase the number of astronomical observers, the greater chance we shall have of acquiring a more accurate and comprehensive knowledge of the bodies which roll in the distant regions of the universe, and of the relations they bear to one another, and to the whole system of nature.

This position might be illustrated by a few examples. The surface of Jupiter has been found to be diversified with a variety of spots and belts: the belts, which are considerably darker than the general surface of the planet, are observed to vary in their number, distance, and position. Sometimes only one or two, and sometimes seven or eight belts have been observed; sometimes they are quite distinct, and at other times they seem to run into each other; and, in some instances, the whole surface of this planet has appeared to be covered with small curved belts that were not continuous across his disk.

The preceding figures represent some of the diversified views which Jupiter sometimes exhibits.

Fig. 1 is copied from Dr. Long, and appears to be one of the views of this planet taken by the celebrated Cassini. It consists of about nine different belts. *Fig*. 2 is copied from Schroeter, and exhibits a view of Jupiter about the time of its occultation by the moon, on the 7th of April, 1792. *Fig*. 3 is one of Sir W. Herschel's views of this planet, as it appeared on the 28th May, 1780, when the whole disk of Jupiter appeared covered with small curved belts, or rather lines, that were not continuous across his disk. *Fig*. 4 contains a view which is nearly the appearance which Jupiter exhibits at present, and which is not much different from his appearance for several years past. These appearances may be seen by a good achromatic telescope, magnifying from 80 to 150 times. These views demonstrate, that changes of considerable magnitude are occasionally taking place, either on the surface or in the atmosphere of this planet, which it would be of some importance to ascertain, in order to our acquiring a more intimate knowledge of the physical constitution of this globe. Now, were a number of observers, in different places, to mark these appearances, and to delineate the aspect of this planet during the space of two or three periodical revolutions,* marking the periods of the different changes, and noting at the same time the positions of his satellites—it might be ascertained, whether these changes are occasioned by tides, which are differently affected according to the position of his moons, or, by immense strata of clouds, or other changes that take place in his atmosphere, or by some great physical revolutions which are occasionally agitating the surface of this planet. The observers of such facts behoove to be numerous, in order that the deficiencies of one might be supplied by another, and the general conclusions deduced from a comparison of all the observations taken together; and it would be requisite that the places of observation be in different countries, that the deficiency of observations in one place, occasioned by a cloudy atmosphere, might be compensated by those made in the serene sky of another. Such a series of observations, although they should not lead to satisfactory conclusions in relation to the particulars now stated, could scarcely fail of throwing some additional light on the nature and constitution of this planet.

With respect to the planet *Venus*, the author some time ago ascertained, from observation,† that this planet may be distinctly seen in the daytime, at the time of its *superior* conjunction with the sun, when it presents to the earth a full enlightened hemisphere; provided its geocentric latitude, or distance from the sun's centre at the time, be not less than 1° 43′. This is the only position (except at the time of a transit, which happens only once or twice in a hundred years) in which the polar and equatorial diameters of this planet can be measured, and their difference, if any, ascertained, so as to determine whether its figure, like that of the earth and several other planets, be *spheroidical*. But as this planet may not happen for a series of years to be in the precise position for such an observation, the attempt to determine the points now stated, even when the planet happens to be placed in the requisite circumstances, would, in all probability, fail, if a number of observers at the same time, in different places, were not engaged in the observation; on account of the uncertainty of enjoying a serene sky at one particular place, during the moments when the observation behooved to be made. Whereas, by a multitude of observations in different places, the object in view could not fail of being determined. The disputes respecting the period of rotation of this planet (whether it be 23 hours 20 minutes, or 24 days 8 hours) might also be settled, were a number of persons to observe its surface with equatorial telescopes in the daytime; particularly in those southern climes where the air is serene, and the sky exhibits a deep azure, where, in all probability, spots would be discovered, which could be traced in their motions for successive periods of twelve hours or more, which would determine to a certainty the point in question.

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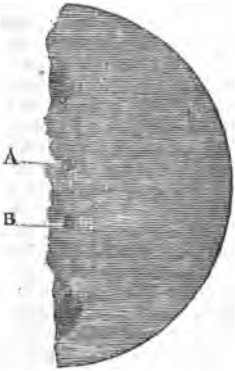
* The annual or periodical revolution of Jupiter is completed in about eleven years and ten months.

† See Nicholson's Phil. Journal, vol. xxxvi. for Oct. 1813; Edin. Phil. Journal, No. V. for July, 1820; Monthly Mag. Feb. 1814, and August, 1820, p. 62; Scot's Magazine for [illegible], p. 84, &c.

The following figure and explanation will perhaps tend to show the reason of the dispute which has arisen in reference to this point. Let A represent a spot on the surface of Venus. As this planet is seen, by the naked eye,



only in the morning a little before sunrise, or in the evening a short time after sunset—the motion of the spot cannot be traced above an hour or two in succession; and, consequently, during that time, its progressive motion is almost imperceptible. Suppose the observation to have been made in the evening, after sunset; the next observation cannot be made till about the same time on the following evening, when it is found that the spot has moved from A to B. But it is still uncertain whether the spot has only moved from A to B since the last observation, or has finished a complete revolution, and moved the distance AB as part of another revolution round the axis of the planet. This point can only be ascertained by tracing the motion of the spot without interruption for 10, 12, or 14 hours, when, if the rotation is performed in 23½ hours, the motion of the spot could be traced without interruption across the whole disk of the planet. But such an observation could only be made in the daytime, in a serene sky, and by means of equatorial instruments, and by numbers of observers in different places where the attention is directed to the same object. But the limits to which I am confined, in throwing out these cursory hints, prevent me from entering into minute details.

In regard to *comets*, it is scarcely necessary to remark, that were the number of those whose attention is directed to a survey of the heavens considerably increased, many of those eccentric bodies which pass and repass within the orbits of the planets without being perceived, could not fail of being detected. Were multitudes of such persons engaged in exploring the celestial regions on opposite sides of the globe, those comets which pass within the limits of our view, and which are above our horizon only in the daytime, and consequently invisible, would be detected during the night by our antipodes in the opposite regions of the globe. By this means the number of those bodies belonging to our system, the diversified phenomena they present, the form of their trajectories, the periods of their revolutions, the nature of their tails, and their ultimate destination might be more accurately determined. With respect to the *fixed stars*, particularly those termed *variable stars*, the results of a multitude of observations made by different persons, might lead us to determine whether those changes in brightness which they undergo arise from the transits of large planets revolving around them, and thus furnish direct evidence of their being the centres of systems analogous to our own,—or whether they be occasioned by large spots which periodically interpose between our sight, and then disappear in the course of their rotation,—or whether the distance of such stars be changed by their revolving in a long narrow eclipse, whose transverse axis is situated nearly in our line of vision. In the several instances now stated, an immense variety of successive observations, by numerous observers at different stations, are requisite to accomplish the ends in view; but the limits of this section prevent me from entering into those details requisite for rendering the hints now suggested perspicuous to those who have not devoted their attention to this subject.

The *Moon* being the nearest celestial body to the earth, it might have been expected that the variety of scenery on her surface, and even some parts of her physical constitution, might have been ascertained and delineated. Yet all that has hitherto been discovered with certainty in relation to this body is, that her surface is strikingly diversified with mountains and valleys, with vast caverns or hollows surrounded with mountainous ridges, and with several elevated peaks, which rise, like a sugar-loaf, from the middle of the plains. We have no accurate delineation of the lunar scenery, as exhibited in the various stages of the moon's increase and decrease, except those which have been published by Hevelius and Scroeter, which have never been translated into our language, and, consequently, are very little known. Most of our English books on astronomy contain nothing more than a paltry and inaccurate view of the *full moon*, which has been copied by one engraver from another, without any improvements, ever since the days of Ricciolus, and long before the telescope was brought to its present state of improvement. It is not from a telescopic view of the *full* moon that any specific deductions can be made respecting the appearance and arrangement of her diversified scenery; but from long-continued observations of her surface about the period of the quadratures, and at the times when she assumes a crescent or a gibbous phase; for it is only at such times that the shadows of her cavities and mountain-ridges can be distinctly perceived. As there is none of the celestial bodies whose constitution and scenery we have so excellent an opportunity of inspecting, had we a sufficient number of astronomical observers, furnished with good telescopes, the surface of this globe might be almost as accurately delineated as that of the earth, and the most prominent changes that take place on its surface plainly detected. In order to bring to light the minute parts of its scenery, it would only be requisite to distribute the entire surface of this luminary among a hundred or a thousand observers, allotting to each one or more spots as the particular object of his attention, with the understanding that he is to inspect them with care through every variety of shade they may exhibit, and during the different stages of the moon's increase and decrease, and delineate the different aspects they may present. When we consider, that by means of a telescope which magnifies 200 times, an object on the moon that measures only 600 yards may be perceived as a visible point, and by one which magnifies 800 times, an object not larger than 150 yards in diameter may be distinguished—we can scarcely entertain a doubt that a number of interesting discoveries might soon be made on the lunar surface, were such minute observations as those now suggested to be continued for a series of years, which might afford sensible and demonstrative evidence of the moon's being a habitable world. But before attention to such objects become general, and the number of astronomical observers be increased far beyond what it is at present, such discoveries can scarcely be expected.

I shall only remark further on this head, that several discoveries have been made by accidentally directing a telescope to certain parts of the heavens. It is well known that Miss Herschel, while amusing herself in looking at the heavens through Sir William Herschel's telescope, discovered at different times a variety of comets, which might otherwise have passed unnoticed by the astronomical world; and several of the new planets which have been discovered within the last fifty or sixty years, were detected when the discoverers were employed making observations with a different object in view. The splendid comet which appeared in our hemisphere in 1811 was first discovered in this country by a *sawyer*,* who, with a reflecting telescope of his own construction, and from his *sawpit* as an observatory, descried that celestial visitant before it had been noticed by any other astronomer in North Britain. The author of this work detected this comet a day or two afterward, before he had been informed of the discovery, while he was taking a random sweep over the northern region of the heavens. He had directed his telescope to a certain star in the neighbourhood of *Ursa Major*, and immediately afterward, taking a general sweep upwards and downwards, and to the east and west, an uncommon object appeared in the field of view, which, after a little inspection, was perceived to be a comet, and he naturally concluded that he had made the first discovery, till the newspapers afterward informed him that it had been detected a day or two before. It was while Sir W. Herschel was inspecting some small stars near the foot of *Castor*, with a different object in view, that he discovered the planet which bears his name, and which he at first took for a comet. It had been seen thirty years before, but for want of numerous observers to mark its motions, it had been marked in catalogues as a fixed star. It was while Mr. Harding of Lilienthal, near Bremen, was forming an atlas of the stars so far as the eighth magnitude, that, on the 1st September, 1804, he discovered in the constellation Pisces the planet Juno, one of the four asteroids situated between the orbits of Mars and Jupiter.

If, therefore, instead of a few individuals occasionally engaged in surveying celestial phenomena, and chiefly confined to a small portion of Europe,—were thousands and ten thousands of telescopes daily directed to the sky from every region of the earth, and were distinct portions of the heavens allotted to distinct classes of observers, as the object of their more immediate research, every portion of that vast concave, with the numerous globes which roll within its wide circumference, as far as human vision assisted by art can penetrate, would ere long be thoroughly explored, and its hidden worlds disclosed to view. No comet could pass within the orbit of Jupiter without being detected,—the undiscovered planets belonging to our system, if any still remain, would be brought to view,—the periodical changes on the surfaces and in the atmospheres of the planets already discovered, with all their diversified phenomena, would be more accurately ascertained and delineated,—the path of the solar system in absolute space, the velocity of its motion, the distant centre about which it revolves, and the centre of gravity of the nebula to which it belongs, might be determined,—the changes and revolutions that are taking place among the fixed stars,—the undiscovered strata of *nebulæ*,—the old systems that are going into decay,—the new creations that may be emerging into existence, and many other sublime objects which at present lie concealed in the unexplored regions of space, might be brought within the range of human contemplation, and astronomy, the sublimest of all the sciences, approximate towards perfection.

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* The name of this gentleman is Mr. Veitch, and I believe he resides in the neighbourhood of Kelso.

For making the observations now supposed, a profound knowledge of the physical and mathematical principles of astronomy is not absolutely necessary. All the qualifications essentially requisite are,—a general knowledge of the elements of the science, of the celestial phenomena which have already been explored, and of the method of determining the right ascension and declination of any observed phenomenon,—qualifications which every person of common understanding can easily acquire.

I might next have illustrated the general position laid down in the beginning of this section from the science of *chymistry*. This science, having for its object to ascertain the ingredients that enter into the composition of bodies, the nature of those ingredients, the manner in which they combine, and the properties resulting from their combination,—or, in other words, an analytical examination of the material world, and the principles which concur to produce its diversified phenomena; it is apparent, at first view, that an immense number and variety of experiments are indispensably requisite for accomplishing such objects; and, consequently, that its progress towards perfection cannot be accelerated unless multitudes of experimenters concur in observing the phenomena of nature, and the processes of the arts, in instituting analytical experiments, and in prosecuting every inquiry which has a tendency to promote its improvement. It is chiefly in consequence of the increased number of its cultivators that this science has risen to the distinguished rank it now holds among the useful departments of human knowledge, and that so many brilliant discoveries have rewarded the investigations of its votaries. Wrenched from the grasp of empirics and alchymists, and no longer confined to the paltry object of searching for the *philosopher's stone*, it extends its range over every object in the material world, and sheds its influence over all the other departments of physical science; and as its votaries increase in numbers and in perseverance, it will doubtless bring to light scenes and discoveries still more interesting and brilliant than those which have hitherto been disclosed. Illustrations of the same description might also have been taken from optics, electricity, magnetism, galvanism, pneumatics, and other departments of natural science; but having protracted this section to a disproportionate length, the instances already stated will, I presume, be sufficient to prove the truth of the position, "*that a general diffusion of knowledge would have a powerful influence on the progress of science.*"

From the few hints now given, and from many others that might have been suggested, had my limits permitted, it will appear, that much still remains to be accomplished till any science, even those which are farthest advanced, arrive at perfection. The reason is obvious; the scene of universal nature has never yet been thoroughly surveyed, and never will be, till the eyes and the intellects of millions be fixed in the contemplation of its multifarious and diversified objects and relations. Till the universe, in all its aspects, so far as it lies within the range of human inspection, be more particularly explored, clouds and darkness will continue to rest on many interesting departments of knowledge, and many of our most specious theories in the sciences must be considered as reposing on slender and unstable foundations. Prior to the introduction of the inductive method of philosophizing, men of science were extremely prone to the framing of hypotheses, before they had attentively surveyed and collected the requisite facts, and when only a few scattered fragments of nature were present to their view. Theory was reared upon theory, and system upon system; each of them obtained its admirers and its period of applause, but, in consequence of modern researches, they have now passed away like a dream or a vision of the night. The crystalline spheres with which Ptolemy had enclosed the heavens are now dashed to pieces; the vortices of Des Cartes have long since ceased their whirling; the terraqueous globe which Tycho had fixed in the centre of the universe is now set in rapid motion through the heavens, in company with the planetary orbs; and the abyss of water with which Burnet had filled the internal cavity of the earth is now converted into a mass denser than the solid rock. The *Terra Australis Incognito*, which served as a prop to certain theories, has completely evanished, and is now transformed into a dreary mass of water and ice. The subtile *ether*, which formerly accounted for so many phenomena, is now evaporated into electricity and heat. Whiston's idea of the cometary origin of our globe, and Buffon's fancy of the earth's being a splinter struck from the body of the sun, are fast sinking into oblivion; and such will be the fate of every theory, however specious, which is not founded on the broad basis of inductive evidence.

Even in the present day, there is still too great a propensity to generalize, without submitting to the trouble of observing phenomena, and noting their various modifications and attendant circumstances. The human mind is impatient, and attempts to reach the goal by the shortest and most rapid course, while observation and experiment are tedious and slow. Instead of surveying the material world with his own eyes, and investigating, by observation and experiment, its principles and laws, the man of genius frequently shuts himself up in his closet, and from a few scattered fragments of nature, constructs, in his imagination, a splendid theory, which makes a noise and a blaze for a little, like an unsubstantial meteor, and then evanishes into air. The system of nature, though directed in its general movements by a few simple laws, is too grand and extensive, and too complex in many of its parts, to be grasped by a few individuals, after a cursory survey; and, therefore, to attempt to comprehend its multifarious revolutions, phenomena and objects within the range of theories founded on a partial view of some of its detached parts, is not only an evidence of presumption and folly, but tends to damp our ardour in prosecuting the only sure path which leads to discovery, and to frustrate what appears to be one of the designs of the Creator, namely, *to grant to the intelligent inhabitants of our globe a gradual display of his stupendous plans in the universe as the reward of their incessant and unwearied contemplation of his wondrous works.*

Were the period arrived (and of its arrival I entertain no doubt, from the present movements of the human mind) when the majority of mankind shall devote a portion of their time and attention to the purposes of science, and to the contemplation of nature—then the different tastes of individuals, and the various situations in which they may be placed, would lead them to cultivate more particularly the science most congenial to their minds; and were distinct departments of the same science marked out for distinct classes of individuals, as the more immediate field of their investigation, on the principle of the division of labour, every leading principle and fact in relation to that science would soon be detected and illustrated in all its practical bearings. Even as matters at present stand, were the whole literary and scientific world to form itself into one great republic, and to allot the several branches of every department of knowledge to the different classes of such a community, according to their respective tastes and pursuits, as the object of their more particular attention, it might be followed by many interesting results, and important discoveries and improvements. But we live in too early a period in the history of science to expect a general interest to be taken in such objects; we are but just emerging from the gloom of ignorance and superstition; the great body of mankind still suffer their faculties to lie in a state of languor and inactivity, and those who are more vigorous and alert are too much engrossed in commercial speculations, in grasping at power and opulence, and in the indulgence of sensual gratifications, to think of attending to the interests of science and the progress of the human mind. Much, however, might be accomplished in this respect, with ease and pleasure, by various classes of society, and without interfering with their ordinary avocations, were their minds inclined and their attention directed to such pursuits. Sailors, in crossing the Atlantic, the Pacific, and the Indian oceans, have frequently excellent opportunities of observing the phenomena of the waters, the atmosphere, and the heavens, peculiar to the climates through which they pass; and were the facts presented to their view observed with care, classified, and recorded, they might, in many instances, contribute to the advancement of science. But thousands of such persons can sail twice "from Indus to the frozen pole, as ignorant as their *log*, and as stubborn as their compass," without importing one intellectual acquisition. The observations made during a single voyage across the Atlantic, by a single observer, M. Humboldt, on the aspect of the Antarctic region of the heavens—the peculiar azure of the African sky—the luminous meteors of the atmosphere—the tides, the currents, and the different colours of the ocean, and other phenomena which happened to present themselves to his view—are of more value to the scientific world than the observations of ten thousands of other beings who, for a series of years, have traversed the same regions. Yet these possessed, on an average, the same sentient organs, the same intellectual powers, though somewhat differently modified and directed, the same natural capacities for observation as this distinguished philosopher, which required only an impulse to be given in a certain direction, in order to accomplish the same ends. And was Humboldt more burdened and perplexed, or did he feel less comfortable and happy, than his ignorant and grovelling associates in the ship that wafted them across the ocean? No. He felt emotions of delight and intellectual enjoyments to which they were utter strangers. While they were lolling on their hammocks, or loitering upon deck, viewing every object with a "brute unconscious gaze," and finding no enjoyment but in a glass of grog,—a train of interesting reflections, having a relation to the past, the present, and the future, passed through the mind of this philosopher. He felt those exquisite emotions which arise from a perception of the beautiful and the sublime; he looked forward to the advancement of natural science as the result of his observations, and beheld a display of the wisdom and grandeur of the Almighty in the diversified scenes through which he passed. Such observations and mental employments as those to which I allude, so far from distracting the mind, and unfitting it for the performance of official duties, would tend to prevent that languor and *ennui* which result from mental inactivity, and would afford a source of intellectual enjoyment amid the uniformity of scene which is frequently presented in the midst of the ocean.

From the whole that has been now stated on this subject it appears, that in order to make science advance with accelerated steps, and to multiply the sources of mental enjoyment, we have only to set the machinery of the human mind (at present in a quiescent state) in motion, and to direct its movements to those objects which are congenial to its native dignity and its high destination. The capacity of the bulk of mankind for learning mechanical employments, and for contriving and executing plans of human destruction, proves that they are competent to make all the researches requisite for the improvement of science. The same mental energies now exerted in mechanical labour, and in the arts of mischief, if properly directed, and acting in unison, and accompanied with a spirit of perseverance, would accomplish many grand and beneficent effects, in relation both to the physical and moral world, and would amply compensate the occasional want of extraordinary degrees of mental vigour. Were only a hundred millions of eyes and of intellects (or the tenth part of the population of our globe) occasionally fixed on all the diversified aspects, motions, and relations of universal nature, it could not fail of being followed by the most noble and interesting results, not only in relation to science, but to social and moral order, and to the general melioration of mankind. Were this supposition realized, our travellers, merchants and mariners, along with the produce of foreign lands, might regularly import, without the least injury to their commercial interests, interesting facts, both physical and moral, scientific observations, chymical experiments, and various other fragments of useful information for rearing the Temple of Science, and extending the boundaries of human knowledge,

SECTION IV.

On the Pleasures and Enjoyments connected with the Pursuits of Science.

Man is a compound being; his nature consists of two essential parts, body and mind. Each of these parts of the human constitution has its peculiar uses, and is susceptible of peculiar gratifications. The body is furnished with external senses, which are both the sources of pleasure and the inlets of knowledge; and the Creator has furnished the universe with objects fitted for their exercise and gratification. While these pleasures are directed by the dictates of reason, and confined within the limits prescribed by the Divine law, they are so far from being unlawful, that in the enjoyment of them we fulfil one of the purposes for which our Creator brought us into existence. But the pursuit of sensitive pleasures is not the ultimate end of our being; we enjoy such gratifications in common with the inferior animals; and in so far as we rest in them as our chief good, we pour contempt on our intellectual nature, and degrade ourselves nearly to the level of the beasts that perish.

Man is endowed with intellectual powers, as well as with organs of sensation,—with faculties of a higher order, and which admit of more varied and sublime gratifications, than those which the senses can produce. By these faculties we are chiefly distinguished from the lower orders of animated existence; in the proper exercise and direction of them, we experience the highest and most refined enjoyments of which our nature is susceptible, and are gradually prepared for the employments of that immortal existence to which we are destined. The corporeal senses were bestowed chiefly in subserviency to the powers of intellect, and to supply materials for thought and contemplation; and the pleasures peculiar to our intellectual nature, rise as high above mere sensitive enjoyments, as the rank of man stands in the scale of existence above that of the fowls of the air, or the beasts of the forest. Such pleasures are pure and refined; they are congenial to the character of a rational being; they are more permanent than mere sensitive enjoyments; they can be enjoyed when worldly comforts are withdrawn, and when sensual gratifications can afford no delight; they afford solace in the hours of retirement from the bustle of business, and consolation amid the calamities and afflictions to which humanity is exposed; and the more we acquire a relish for such pleasures, the better shall we be prepared for associating with intelligences of a higher order in the future world.

Before proceeding to the more particular illustration of this topic, let us consider the state and the enjoyments of the man whose mind is shrouded in ignorance. He grows up to manhood like a vegetable, or like one of the lower animals that are fed and nourished for the slaughter. He exerts his physical powers, because such exertion is necessary for his subsistence; were it otherwise, we should most frequently find him dozing over the fire, or basking in the sun, with a gaze as dull and stupid as his ox, regardless of every thing but the gratification of his appetites. He has perhaps been taught the art of reading, but has never applied it to the acquisition of knowledge. His views are chiefly confined to the objects immediately around him, and to the daily avocations in which he is employed. His knowledge of society is circumscribed within the limits of his parish, and his views of the world in which he dwells are confined within the range of the country in which he resides, or of the blue hills which skirt his horizon. Of the aspects of the globe in other countries—of the various tribes with which they are peopled—of the seas and rivers, continents and islands which diversify the landscape of the earth—of the numerous orders of animated beings which people the ocean, the atmosphere, and the land,—of the revolutions of nations, and the events which have taken place in the history of the world, he has almost as little conception as the animals that range the forest, or bound through the lawns. In regard to the boundless regions that lie beyond him in the firmament, and the bodies that roll there in magnificent grandeur, he has the most confused and inaccurate ideas; and he seldom troubles himself with inquiries in relation to such subjects. Whether the stars be great or small, whether they be near us or at a distance, or whether they move or stand still, is to him a matter of trivial importance. If the sun give him light by day, and the moon by night, and the clouds distil their watery treasures upon his parched fields, he is contented, and leaves all such inquiries and investigations to those who have little else to engage their attention. He views the canopy of heaven as merely a ceiling to our earthly habitation, and the starry orbs as only so many luminous studs or tapers to diversify its aspect, and to afford a glimmering light to the benighted traveller. Of the discoveries which have been made in the physical sciences in ages past, of the wonders of creation which they have unfolded to view, of the instruments which have been invented for exploring the universe, and of the improvements which are now going forward in every department of science and art, and the prospects they are opening to our view, he is almost as entirely ignorant as if he had been fixed under the frozen pole, or chained to the surface of a distant planet. He considers learning as consisting chiefly in the knowledge of grammar, Greek, and Latin; and philosophy and astronomy as the arts of telling fortunes and predicting the state of the weather; and experimental chymistry, as allied to the arts of magic and necromancy. He has no idea of the manner in which the understanding may be enlightened and expanded, he has no relish for intellectual pursuits, and no conception of the pleasures they afford; and he sets no value on knowledge but in so far as it may tend to increase his riches and his sensual gratifications. He has no desire for making improvements in his trade or domestic arrangements, and gives no countenance to those useful inventions and public improvements which are devised by others. He sets himself against every innovation, whether religious, political, mechanical, or agricultural, and is determined to abide by the "good old customs" of his forefathers, however irrational and absurd. Were it dependent upon him, the moral world would stand still, as the material world was supposed to do in former times; all useful inventions and improvements would cease, existing evils would never be remedied, ignorance and superstition would universally prevail, the human mind would be arrested in its progress to perfection, and man would never arrive at the true dignity of his intellectual nature.

It is evident that such an individual (and the world contains thousands and millions of such characters) can never have his mind elevated to those sublime objects and contemplations which enrapture the man of science, nor feel those pure and exquisite pleasures which cultivated minds so frequently experience; nor can he form those lofty and expansive ideas of the Deity which the grandeur and magnificence of his works are calculated to inspire. He is left as a prey to all those foolish notions and vain alarms which are engendered by ignorance and superstition; and he swallows, without the least hesitation, all the absurdities and childish tales respecting witches, hobgoblins, spectres, and apparitions, which have been handed down to him by his forefathers in former generations. And while he thus gorges his mind with fooleries and absurdities, he spurns at the discoveries of science, as impositions on the credulity of mankind, and contrary to reason and common sense. That the sun is a million of times larger than the earth, that light flies from his body at the rate of two hundred thousand miles in a moment of time, and that the earth is whirling round its axis from day to day, with a velocity of a thousand miles every hour, are regarded by him as notions far more improbable and extravagant than the story of the "Wonderful Lamp," and all the other tales of the "Arabian Nights' Entertainments." In his hours of leisure from his daily avocations, his thoughts either run wild among the most grovelling objects, or sink into sensuality or inanity, and solitude and retirement present no charms to his vacant mind. While human beings are thus immersed in ignorance, destitute of rational ideas, and of a solid substratum of thought, they can never experience those pleasures and enjoyments which flow from the exercise of the understanding, and which correspond to the dignity of a rational and immortal nature.

On the other hand, the man whose mind is irradiated with the light of substantial science has views, and feelings, and exquisite enjoyments to which the former is an entire stranger. In consequence of the numerous and multifarious ideas he has acquired, he is introduced, as it were, into a new world, where he is entertained with scenes, objects, and movements of which a mind enveloped in ignorance can form no conception. He can trace back the stream of time to its commencement; and, gliding along its downward course, can survey the most memorable events which have happened in every part of its progress from the primeval ages to the present day—the rise of empires, the fall of kings, the revolutions of nations, the battles of warriors, and the important events which have followed in their train —the progress of civilization, and of arts and sciences—the judgments which have been inflicted on wicked nations—the dawnings of Divine mercy towards our fallen race—the manifestation of the Son of God in our nature—the physical changes and revolutions which have taken place in the constitution of our globe—in short, the whole of the leading events in the chain of Divine dispensation from the beginning of the world to the period in which we live. With his mental eye he can survey the terraqueous globe in all its variety of aspects; contemplate the continents, islands, and oceans which compose its exterior, the numerous rivers by which it is indented, the lofty ranges of mountains which diversify its surface, its winding caverns, its forests, lakes, sandy deserts, ice-islands, whirlpools, boiling springs, glaciers, sulphuric mountains, bituminous lakes, and the states and empires into which it is distributed, the tides and currents of the ocean, the icebergs of the polar regions, and the verdant scenes of the torrid zone. He can climb, in imagination, to the summit of the flaming volcano, listen to its subterraneous bellowings, behold its lava bursting from its mouth and rolling down its sides like a flaming river—descend into the subterranean grotto—survey, from the top of the Andes, the lightnings flashing and the thunders rolling far beneath him—stand on the brink of the dashing cataract and listen to its roarings—contemplate the ocean rearing its billows in a storm, and the hurricane and tornado tearing up forests by their roots, and tossing them about as stubble. Sitting at his fireside, during the blasts of winter, he can survey the numerous tribes of mankind scattered over the various climates of the earth, and entertain himself with views of their manners, customs, religion, laws, trade, manufactures, marriage ceremonies, civil and ecclesiastical governments, arts, sciences, cities, towns, and villages, and the animals peculiar to every region. In his rural walks he can not only appreciate the beneficence of Nature, and the beauties and harmonies of the vegetable kingdom, in their exterior aspect, but can also penetrate into the hidden processes which are going on in the roots, trunks, and leaves of plants and flowers, and contemplate the numerous vessels through which the sap is flowing from their roots through the trunks and branches, the millions of pores through which their odoriferous effluvia exhale, their fine and delicate texture, their microscopical beauties, their orders, genera, and species, and their uses in the economy of nature.

With the help of his microscope, he can enter into a world unknown to the ignorant, and altogether invisible to the unassisted eye. In every plant and flower which adorns the field, in every leaf of the forest, in the seeds, prickles, and down of all vegetables, he perceives beauties and harmonies, and exquisite contrivances, of which, without this instrument, he could have formed no conception. In every scale of a haddock he perceives a beautiful piece of net-work, admirably contrived and arranged, and in the scale of a sole a still more diversified structure, which no art could imitate, terminated with pointed spikes, and formed with admirable regularity. Where nothing but a speck of *mouldiness* appears to the naked eye, he beholds *a forest of mushrooms* with long stalks, and with leaves and blossoms distinctly visible. In the eyes of a common fly, where others can see only two small protuberances, he perceives several thousands of beautiful transparent globes, exquisitely rounded and polished, placed with the utmost regularity in rows, crossing each other like a kind of lattice-work, and forming the most admirable piece of mechanism which the eye can contemplate. The small dust that covers the wings of moths and butterflies he perceives to consist of an infinite multitude of feathers of various forms, not much unlike the feathers of birds, and adorned with the most bright and vivid colours. In an animal so small that the naked eye can scarcely distinguish it as a visible point, he perceives a head, mouth, eyes, legs, joints, bristles, hair, and other animal parts and functions, as nicely formed and adjusted, and endowed with as much vivacity, agility, and intelligence, as the larger animals. In the tail of a small fish, or the foot of a frog, he can perceive the variegated branchings of the veins and arteries, and the blood circulating through them with amazing velocity. In a drop of stagnant water he perceives thousands of living beings, of various shapes and sizes, beautifully formed, and swimming with wanton vivacity like fishes in the midst of the ocean. In short, by this instrument he perceives that the whole earth is full of animation, and that there is not a single tree, plant, or flower, and scarcely a drop of water, that is not teeming with life, and peopled with its peculiar inhabitants. He thus enters, as it were, into a new world, invisible to other eyes, where every object in the animal, vegetable, and mineral kingdoms presents a new and interesting aspect, and unfolds beauties, harmonies, contrasts, and exquisite contrivances, altogether inconceivable by the ignorant and unreflecting mind.

In the invisible atmosphere which surrounds him, where other minds discern nothing but an immense blank, he beholds an assemblage of wonders, and a striking scene of Divine Wisdom and Omnipotence. He views this invisible agent not only as a *material* but as a *compound* substance—compounded of two opposite principles, the one the source of flame and animal life, and the other destructive to both, and producing by their different combinations, the most diversified and beneficent effects. He perceives the atmosphere, as the agent under the Almighty, which produces the germination and growth of plants, and all the beauties of the vegetable creation—which preserves water in a liquid state—supports fire and flame, and produces animal heat, which sustains the clouds, and gives buoyancy to the feathered tribes—which is the cause of winds—the vehicle of smells—the medium of sounds—the source of all the pleasures we derive from the harmonies of music—the cause of that universal light and splendour which is diffused around us, and of the advantages we derive from the morning and evening twilight. In short, he contemplates it as the prime mover in a variety of machines,—as impelling ships across the ocean, blowing our furnaces, grinding our corn, raising water from the deepest pits, extinguishing fires, setting power-looms in motion, propelling steamboats along rivers and canals, raising balloons to the region of the clouds, and performing a thousand other beneficent agencies without which our globe would cease to be a habitable world. All which views and contemplations have an evident tendency to enlarge the capacity of the mind, to stimulate its faculties, and to produce rational enjoyment.

Again,—the man of knowledge, even when shrouded in darkness, and in solitude, where other minds could find no enjoyment, can entertain himself with the most sublime contemplations. He can trace the huge globe on which we stand flying through the depths of space, carrying along with it its vast population, at the rate of sixty thousand miles every hour, and, by the inclination of its axis, bringing about the alternate succession of summer and winter, spring and harvest. By the aid of his telescope he can transport himself towards the moon, and survey the circular plains, the deep caverns, the conical hills, the lofty peaks, the shadows of the hills and vales, and the rugged and romantic mountain scenery which diversify the surface of this orb of night. By the help of the same instrument he can range through the planetary system, wing his way through the regions of space along with the swiftest orbs, and trace many of the physical aspects and revolutions which have a relation to distant worlds. He can transport himself to the planet Saturn, and behold a stupendous ring, 600,000 miles in circumference, revolving in majestic grandeur every ten hours around a globe nine hundred times larger than the earth, while seven moons, larger than ours, along with an innumerable host of stars, display their radiance, to adorn the firmament of that magnificent world. He can wing his flight to the still more distant regions of the universe, leaving the sun and all his planets behind him, till they appear like a scarcely discernible speck in creation, and contemplate thousands and millions of stars and starry systems, beyond the range of the unassisted eye, and wander among suns and worlds dispersed throughout the boundless dimensions of space. He can fill up, in his imagination, those blanks which astronomy has never directly explored, and conceive thousands of systems and ten thousands of worlds, beyond all that is visible by the optic tube, stretching out to infinity on every hand,—new creations incessantly starting into existence—peopled with intelligences of various orders, and all under the superintendence and government of the "King Eternal, Immortal, and Invisible," whose power is omnipotent, and the limits of his dominions past finding out.

It is evident that a mind capable of such excursions and contemplations as I have now supposed, must experience enjoyments infinitely superior to those of the individual whose soul is enveloped in intellectual darkness. If substantial happiness is chiefly seated in the mind, if it consists in the vigorous exercise of its faculties, if it depends on the multiplicity of objects which lie within the range of its contemplation, if it is augmented by the view of scenes of beauty and sublimity, and displays of infinite intelligence and power, if it is connected with tranquillity of mind, which generally accompanies intellectual pursuits, and with the subjugation of the pleasures of sense to the dictates of reason—the enlightened mind must enjoy gratifications as far superior to those of the ignorant, as man is superior in station and capacity to the worms of the dust.

In order to illustrate this topic a little further, I shall select a few facts and deductions in relation to science which demonstrate the interesting nature and delightful tendency of scientific pursuits.

Every species of rational information has a tendency to produce pleasing emotions. There is a certain gratification in becoming acquainted with objects and operations of which we were formerly ignorant, and that, too, altogether independent of the practical tendency of such knowledge, of the advantages we may expect to reap from it, or the sensitive enjoyments with which it may be accompanied. A taste for knowledge, a capacity to acquire it, and a pleasure accompanying its acquisition, form a part of the constitution of every mind. The Creator has implanted in the human mind a principle of curiosity, and annexed a pleasure to its gratification to excite us to investigations of the wonders of creation he has presented before us, to lead us to just conceptions of his infinite perfections, and of the relation in which we stand to him as the subjects of his government. We all know with what a lively interest most persons peruse novels and romances, where hair-breadth escapes, mysterious incidents, and tales of wonder are depicted with all the force and beauty of language. But the scenes detailed in such writings produce only a momentary enjoyment. Being retraced as only the fictions of a lively imagination, they pass away like a dream or a vision of the night, leaving the understanding bewildered and destitute of any solid improvement. In order to improve the intellectual faculties while we gratify the principle of curiosity, it is only requisite that we direct the attention to *facts* instead of fictions; and when the *real scenes* of the universe are presented in an interesting aspect, they are calculated to produce emotions of wonder and delight even superior to those excited by the most highly-wrought tales of fiction and romance. The following facts and considerations will perhaps tend to corroborate this position.

In the first place, *the number of effects produced by a single principle in nature* is calculated to excite emotions of admiration and delight. From the simple principle of *gravitation*, for instance, proceed all the beauties and sublimities which arise from the meandering rills, the majestic rivers, and the roaring cataracts—it causes the mountains to rest on a solid basis, and confines the ocean to its appointed channels—retains the inhabitants of the earth to its surface, and prevents them from flying off in wild confusion through the voids of space—it produces the descent of the rains and dews, and the alternate flux and reflux of the tides—regulates the various movements of all animals—forms mechanical powers—gives impulsion to numerous machines—rolls the moon round the earth, and prevents her from flying off to the distant regions of space—extends its influence from the moon to the earth, from the earth to the moon, and from the sun to the remotest planets, preserving surrounding worlds in their proper courses, and connecting the solar system with other worlds and systems in the remote spaces of the universe. When a stick of sealing wax is rubbed with a piece of flannel, it attracts feathers or small bits of paper; when a long tube of glass, or a cat's back, is rubbed in the dark, it emits flashes of fire, accompanied with a snapping noise. Now, is it not delightful to a rational mind to know, that the same principle which causes wax or amber to attract light substances, and glass tubes or cylinders to emit sparks of fire, produces the lightnings of heaven, and all the sublime phenomena which accompany a violent thunder-storm, and, in combination with other agents, produces also the fiery meteor which sweeps through the sky with its luminous train, and the beautiful coruscations of the aurora borealis? There are more than fifty thousand different species of plants in the vegetable kingdom, all differing from one another in their size, structure, flowers, leaves, fruits, mode of propagation, internal vessels, medicinal virtues, and the odours they exhale. Who would imagine that this immense assemblage of vegetable productions which adorns the surface of the earth in every clime, with such a diversity of forms, fruits, and colours, are the result of the combination of four or five simple substances variously modified by the hand of the Creator? Yet it is an undoubted fact, ascertained from chymical analysis, that all vegetable substances, from the invisible mushroom which adheres to a spot of mouldiness, to the cedar of Lebanon and the banian-tree, which would cover with its shade an army of ten thousand men,—are solely composed of the following natural principles—caloric, light, water, air, and carbon.

Again, is it not wonderful that the invisible atmosphere should compress our bodies every moment with a weight of more than 30,000 pounds without our feeling it, and the whole earth with a weight of 12,043,468,800,000,000,000 *pounds*, or five thousand billions of *tons*; that this pressure is essentially necessary to our existence, and that a small quantity of air within us, which would not weigh above a single ounce, by its strong elastic force counteracts the effects of this tremendous pressure upon our bodies, and prevents our being crushed to pieces—that the same cause prevents our habitations from falling upon us and crushing us to death, without which our glass windows would be shattered to atoms, and our most stately edifices tumbled into ruins!—that this atmosphere is at the same time performing an immense variety of operations in nature and art—insinuating itself into the pores and sap-vessels of plants and flowers—producing respiration in all living beings, and supporting all the processes of life and vegetation throughout the animal and vegetable creation—that its pressure produces the process of what is called *suction* and *cupping*—causes snails and periwinkles to adhere to the rocks on which they are found—gives effect to the adhesion of bodies by means of mortar and cements—raises water in our forcing-pumps and fire-engines—supports the quicksilver in our barometers—prevents the water of our seas and rivers from boiling and evaporating into steam—and promotes the action of our steam-engines while raising water from deep pits, and while propelling vessels along seas and rivers!

In the next place, science contributes to the gratification of the human mind *by enabling us to trace, in many objects and operations, surprising resemblances, where we should* *least of all have expected them.* Who could, at first sight, imagine, that the process of breathing is a species of combustion, or burning—that the diamond is nothing else than *carbon* in a crystallized state, and differs only in a very slight degree from a piece of charcoal—that water is a compound of two invisible airs or gases, and that one of these ingredients is the principle of flame!—that the air which produces suffocation and death in coal-mines and subterraneous grottoes, is the same substance which gives briskness to ale, beer, and soda water, and the acid flavour to many mineral springs—that the air we breathe is composed of the same ingredients, and nearly in the same proportions, as nitric acid or aquafortis, which can dissolve almost all the metals, and a single draught of which would instantly destroy the human frame—that the colour of *white* is a mixture or compound of all the other colours, *red*, *orange*, *yellow*, *green*, *blue*, *indigo*, and *violet*, and consequently, that the white light of the sun produces all that diversity of colouring which adorns the face of nature—that the same principle which causes our fires to burn, forms acids, produces the rust of metals, and promotes the growth of plants by night—that plants breathe and perspire as well as animals—that carbonic acid gas, or fixed air, is the product both of vegetation, of burning, of fermentation, and of breathing—that it remains indestructible by age, and, in all its diversified combinations, still preserves its *identity*—that the air which burns in our street-lamps and illuminates our shops and manufactories, is the same which causes a balloon to rise above the clouds, and likewise extinguishes flame when it is immersed in a body of this gas—that the leaves of vegetables which rot upon the ground, and appear to be lost for ever, are converted by the oxygen of the atmosphere into carbonic acid gas, and this *very same carbon* is, in process of time, absorbed by a new race of vegetables, which it clothes with a new foliage, and again renews the face of nature—and that the same principle which causes the sensation of *heat* is the cause of fluidity, expands bodies in every direction, enters into every operation in nature, flies from the sun at the rate of 195,000 miles in a second of time, and, by its powerful influence, prevents the whole matter of the universe from being converted into a solid mass!

What, then, can be more delightful to a being furnished with such powers as man, than to trace the secret machinery by which the God of nature accomplishes his designs in the visible world, and displays his infinite power and intelligence—to enter into the hidden springs of Nature's operations, to follow her through all her winding recesses, and to perceive from what simple principles and causes the most sublime and diversified phenomena are produced! It is with this view that the Almighty hath set before us his wondrous works, not to be overlooked, or beheld with a "brute unconscious gaze," but to be investigated, in order that they may be admired, and that in such investigations we may enjoy a sacred pleasure in contemplating the results of his wisdom and intelligence.

In the third place, science contributes to our enjoyment *by the grand and sublime objects she presents before us.* In consequence of the investigations which have been made to determine the distances and magnitudes of the heavenly bodies, objects of magnificence and grandeur are now presented to the view of the enlightened mind of which former ages could form no conception. These objects are magnificent in respect of *magnitude*, of *motion*, of *the vast spaces which intervene between them*, and *of the noble purposes for which they are destined.*

What a sublime idea, for example, is presented to the view by such an object as the planet *Jupiter*,—a globe fourteen hundred times larger than the world in which we dwell, and whose surface would contain a population a hundred times more numerous than all the inhabitants that have existed on our globe since the creation! And how is the sublimity of such an idea augmented when we consider, that this immense body is revolving round its axis at the rate of twenty-eight thousand miles in an hour, and is flying, at the same time, through the regions of space, twenty-nine thousand miles every hour, carrying along with it four moons, each of them larger than the earth, during its whole course round the centre of its motion! And if this planet, which appears only like a luminous *speck* on the nocturnal sky, presents such an august idea, when its magnitude and motions are investigated, what an astonishing idea is presented to the mind when it contemplates the size and splendour of the *sun*,—a body which would contain within its bowels nine hundred globes larger than Jupiter, and thirteen hundred thousand globes of the bulk of the earth,—which darts its rays in a few moments to the remotest bounds of the planetary system, producing light and colour, and life and vegetation throughout surrounding worlds! And how must our astonishment be still increased, when we consider the *number* of such globes which exist throughout the universe; that within the range of our telescopes more than eighty millions of globes, similar to the sun in size and in splendour, are arranged at immeasurable distances from each other, diffusing their radiance through the immensity of space, and enlivening surrounding worlds with their benign influence, besides the innumerable multitudes which, our reason tells us, must exist beyond all that is visible to the eyes of mortals!

But the *motions*, no less than the magnitudes, of such bodies present ideas of sublimity. That a globe* as large as the earth should fly through the celestial regions with a velocity of seventy-six thousand miles an hour,—that another globe† should move at the rate of one thousand seven hundred and fifty miles in a minute, and a hundred and five thousand miles an hour,—that even Saturn, with all his assemblage of rings and moons, should be carried along his course with a velocity of twenty-two thousand miles an hour,—that some of the comets, when near the sun, should fly with the amazing velocity of eight hundred thousand miles an hour,—that, in all probability, the sun himself, and all his attending planets, besides their own proper motions, are carried around some distant centre at the rate of more than sixty thousand miles every hour; and that thousands and millions of systems are moving in the same rapid manner, are facts so astonishing, and so far exceeding every thing we behold around us on the surface of the earth, that the imagination is overpowered and confounded at the idea of the astonishing forces which are in operation throughout the universe, and of the power and energy by which they are produced; and every rational being feels a sublime pleasure in the contemplation of such objects which is altogether unknown to the ignorant mind.

The vast and *immeasurable spaces* which intervene between the great bodies of the universe likewise convey august and sublime conceptions. Between the earth and the sun there intervenes a space so vast, that a cannon-ball, flying with the velocity of five hundred miles an hour, would not reach that luminary in twenty years; and a mail-coach, moving at its utmost speed, would not arrive at its surface in less than twelve hundred years; and, were it to proceed from the sun towards the planet Herschel, it would not arrive at that body till after the lapse of *twenty-two thousand years*. And yet the sun, at that immense distance, exerts his attractive energy, retains that huge planet in its orbit, and dispenses light and colour, life and animation, over every part of its surface. But all such spaces, vast as at first sight they appear, dwindle as it were into a span, when compared with those immeasurable spaces which are interposed between us and the regions of the stars. Between the earth and the nearest fixed star a space intervenes so vast and incomprehensible, that a ball flying with the velocity above mentioned, would not pass through it in four million and five hundred thousand years; and as there are stars, visible through telescopes, at least a hundred times farther distant from our globe, it would require such a body four hundred millions of years, or a period 67,000 times greater than that which has elapsed since the Mosaic creation, before it could arrive at those distant regions of immensity.

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* The planet Venus. † The planet Mercury.

The *grand and noble designs* for which the great bodies to which I have adverted are intended, suggest likewise a variety of interesting and sublime reflections. These designs undoubtedly are, to display the ineffable glories of the Eternal Mind,—to demonstrate the immensity, omnipotence, and wisdom of Him who formed the universe,—and to serve as so many worlds for the residence of incalculable numbers of intelligent beings of every order. And what an immense variety of interesting objects is presented to the mind when its views are directed to the numerous orders and gradations of intelligence that may people the universe,—the magnificent scenes that may be displayed in every world,—their moral economy, and the important transactions that may have taken place in their history under the arrangements of the Divine government!

Such are some of the scenes of grandeur which science unfolds to every enlightened mind. The contemplation of such objects has an evident tendency to enlarge the capacity of the soul, to raise the affections above mean and grovelling pursuits, to give man a more impressive idea of the *dignity* of his rational and immortal nature, and of the attributes of that Almighty Being by whom he is upheld, and to make him *rejoice* in the possession of faculties capable of being exercised on scenes and objects so magnificent and sublime.

In the *fourth place*, science administers to our enjoyment by *the variety of novel and interesting objects it exhibits.* Almost every department of natural science presents to the untutored mind an assemblage of objects, new and strange, which tend to rouse its faculties, and to excite to important inquiries and interesting reflections. The science of *mechanics* presents us with many curious combinations of mechanical powers, which, from the simplest principles, produce the most powerful and astonishing effects. "What can be more strange," says a profound and energetic writer,* "than that an ounce weight should balance hundreds of pounds by the intervention of a few bars of thin iron?" And when we consider that all the mechanical powers may be reduced to the *lever*, the *wheel and axle*, the *pulley*, the *inclined plane*, the *wedge*, and the *screw*, how astonishing are the forces exerted, and the effects produced, by their various combinations in wheel-carriages, mills, cranes, thrashing-machines, and pile-engines! *Hydrostatics* teaches us the wonderful fact, that a few pounds of water, without the aid of any machinery, will, by mere pressure, produce an almost irresistible force; or, in other words, that any quantity of fluid, however small, may be made to counterpoise any quantity, however large; and hence a very strong hogshead has been burst to pieces, and the water scattered about with incredible force, by means of water conveyed through a very small perpendicular tube of great length. On the same principle, and by the same means, the foundations of a large building might be shattered and the whole structure overthrown. *Magnetism* discloses to us such singular facts as the following:—that a small piece of steel, when rubbed by the loadstone, and nicely poised, will place itself in a direction nearly north and south, so as to point nearly towards the poles of the world,—that the north and south poles of two loadstones will attract, and two north or two south poles repel each other; and that the power of a magnet will pass through a thick board, and turn round a compass needle with great velocity, though placed at a considerable distance.

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* Lord Brougham.

The science of *optics* likewise discloses a variety of astonishing truths, and is no less replete with wonders. How wonderful the fact, that *light* proceeds from the sun, and other luminous bodies, with a velocity of 195,000 miles in a moment of time; that myriads of myriads of rays are flying off from visible objects towards every point of the compass, crossing each other in all directions, and yet accurately depicting the same images of external objects in thousands of eyes at the same moment,—that the thousands of millions of rays of light which proceed from any particular object must be compressed into a space not more than one-eighth of an inch in diameter, before they can enter the pupil of the eye and produce vision,—that the images of all the objects which compose an extensive landscape are depicted on the bottom of the eye, in all their colours and relative proportions, within a space less than half an inch in diameter,—that the eye can perceive objects distinctly at the distance of six inches, and likewise at the distance of ten, fifty, or a hundred miles, serving the purpose both of a microscope and a telescope, and can be *instantaneously* adjusted to serve either as the one or as the other,—and that the variegated colouring which appears in the scenery of nature is not in the objects themselves, but in the light which falls upon them, without which all the scenes of creation would wear a uniform aspect, and one object would be undistinguishable from another!

The *instruments* which the science of optics has been the means of constructing are also admirable in their effects, and productive of rational entertainment. How wonderful that, by means of an optic lens, an image is depicted in a dark chamber, on a white table, in which we may perceive the objects of an extensive landscape delineated in all their colours, motions, and proportions, and so accurately represented, that we even distinguish the countenances of individuals at the distance of a mile,—that we can see objects distinctly when a thick board, or a piece of metal, is interposed between them and our eye,—that the images of objects can be made to hang in the air either upright or inverted, and that representations either of the living or of the dead can be made to start up instantly before the view of a spectator in a darkened room,—that, by admitting into a chamber a few rays of white light from the sun through a prism, all the colours of light may be seen beautifully painted on a piece of paper,—that a single object may be multiplied to an indefinite number, and that a few coloured bits of glass may be made by reflection to exhibit an infinite diversity of beautiful and variegated forms! How admirable the effects of the telescope, by which we may see objects as distinctly at the distance of two or three miles as if they were placed within a few yards of us; by which we can penetrate into the celestial regions, and behold the distant wonders of the planetary system, and the millions of stars dispersed through infinite space, as distinctly as if we were actually transported by a supernatural power several hundreds of millions of miles into the regions of the firmament! And how curious the circumstance, that we can, by this instrument, contemplate such objects in all directions and positions,—that we can view them either as *erect*, or as turned *upside down*,—that we can perceive the spires, houses, and windows of a distant city, when our backs are turned directly opposite to it, and our faces in a contrary direction—the rings of Saturn and the moons of Jupiter, when we are looking *downwards* with our backs turned to these objects,—that we can make an object on our right-hand or our left appear as if directly before us, and can cause a terrestrial landscape to appear above us, as if it were suspended in the sky.* By the help of the *microscope* we can exhibit to a number of spectators at the same moment a small animal scarcely distinguishable by the naked eye, magnified to the size of ten or fifteen inches in length, and distinguish, not only its limbs, joints, mouth, and eyes, but even the motions of its bowels, and other internal movements; and in every department of nature can contemplate an assemblage of beauties, delicate contextures, and exquisite contrivances, which excite the highest admiration, and which would otherwise have appeared incredible and incomprehensible to the human mind.

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* This is effected by means of the "aerial reflecting telescope," lately invented by the author. The following is a general representation of this telescope in profile:—

The sciences of *electricity* and *galvanism* likewise display

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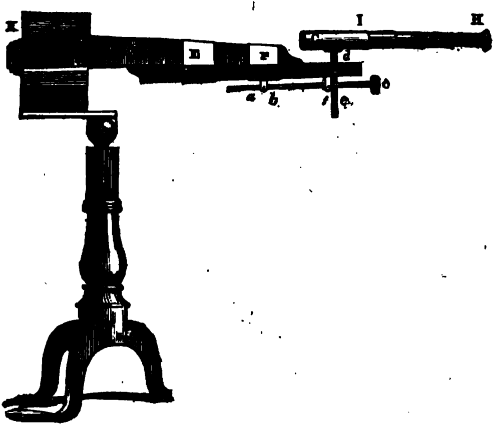

AB is a tube of mahogany about three inches long, which serves as a socket for holding the speculum; CD an arm attached to the tube, about the length of the focal distance of the mirror, consisting of two separate pieces C and D, the latter of which slides under the former, through the brass sockets EF. To the under part of the socket F is attached a brass nut with a female screw, in which the male screw *ab* acts by applying the hand to the knob *c*, which serves for adjusting the instrument to distinct vision. G is the brass tube which receives the eye-pieces. In looking through this telescope, the right eye is applied at the point H, the back is directly towards the object, and the observer's head is understood to be uncovered. When a diagonal eye-piece is applied, the object may be seen either to the right or to the left, or at right angles to its true position; or it may be made to appear either upwards, as if hanging in the air, or downwards, as if below the surface of the earth. A particular description of this instrument may be seen in "The Edinburgh New Philosophical Journal," for July, 1826, p. 41-52, and in the "London Encyclopædia," art. *Telescope.*

facts both curious and astonishing. How wonderful the operations of the electric fluid, which can suddenly contract the muscles of animals, and give a violent shock to a hundred or a thousand persons at the same moment—which moves with such amazing rapidity, that, in a few seconds of time, it might be made to fly to the remotest regions of the globe—which melts iron wire, sets fire to gunpowder and other inflammable substances, destroys the polarity of the magnetic needle, and promotes the vegetation of plants and the perspiration of animals—which can be drawn in vivid sparks from different parts of the human body, and made to descend from the clouds in streams of fire! And how powerful and astonishing the effects of the *galvanic* agency—which makes charcoal burn with a brilliant white flame, decomposes water into its elementary parts, and causes platina, the hardest and heaviest of the metals, to melt as readily as wax in the flame of a candle—which produces the most violent convulsions on the muscular system, causes a hare to move its feet, and a fowl to clap its wings, with force and energy *after life is extinct*—throws the countenance, even of a dead man, into appalling grimaces and contortions, and excites the most rapid movements in his hands and limbs, to the horror and astonishment of all beholders!

The science of *chymistry*, throughout all its departments, is no less replete with wonders. How astonishing are many of the facts which it discloses, of which the following are merely specimens!—That all the productions of nature in the animal and vegetable kingdoms, are composed of a very few simple substances, many of which are invisible gases—that water is chiefly composed of an *inflammable* principle—that the *acids*, such as aquafortis and oil of vitriol, are formed of different kinds of *air*—that an invisible fluid, one of the ingredients of the air we breathe, will cause a rod of iron to burn with brilliancy, and phosphorus to produce a splendour which dazzles the eyes of every beholder—that the *diamond*, notwithstanding its value and brilliancy, is composed of the same materials as *coal*—that oxymuriatic acid, or the bleaching gas, discharges all vegetable colours, and, in the course of a few minutes, will change a piece of printed calico into a pure *white;* and likewise burns all the metals, dissolves gold and platina, and suffocates all animals that breathe it, after one or two inspirations—that there are metals much lighter than water, which swim in that fluid and burn spontaneously with a bright red light, and when thrown into the mineral acids, inflame and burn on the surface, and in oxygen and oxymuriatic acid gas produce a white flame, and throw out numerous bright sparks and scintillations,—that a certain kind of air, called the nitrous oxide, when inhaled into the lungs, produces an extraordinary elevation of the animal spirits, an irresistible propensity to laughter, a rapid flow of vivid ideas, and a thousand delightful emotions, without any subsequent feelings of debility or exhaustion—and that it is not altogether improbable, according to the deductions of some modern chymists, that "*oxygen* and *hydrogen*, with the assistance of the *solar light*, are the only elementary substances employed in the constitution of the whole universe;" so that Nature, in all her operations, works the most infinitely diversified effects, by the slightest modifications in the means she employs.

Such are only a few *specimens* of the curious and interesting subjects which the physical sciences present to the reflecting mind. And is it conceivable that a rational being can make such objects as those I have now specified the subject of his frequent study and contemplation, and not feel pleasures and enjoyments far superior to those of the mass of mankind, who are either immersed in sensuality, or enveloped with the mists of ignorance? The man who has such subjects to study and investigate, and such objects to contemplate, can never be destitute of enjoyment. If happiness depends on the activity of the mind, and the range of objects presented before it,—wherever he is placed, whether at home or abroad, in the city or in the country, he can never be at a loss for means of mental gratification, and of increasing his stock of intellectual wealth. He needs not envy the rich and the noble, on account of the elegance of their mansions and the splendour of their equipage; for the magnificence and glories of the universe, and all the beauties of terrestrial nature, lie before him, and are at all times ready to minister to his enjoyment. In investigating the admirable arrangements which appear in the economy of creation, in tracing throughout that economy the perfections of his Creator, and in looking forward to a nobler state of existence where his views of the divine empire shall be expanded, he can enjoy a satisfaction and delight which the wealth of this world cannot bestow, and which its frowns and calamities cannot destroy.

Besides the pleasures derived from a contemplation of the doctrines and the facts of science,—*there is a positive gratification in tracing the steps by which the discoveries of science have been made,—the reasonings and demonstrations by which its doctrines are supported, and the experiments by which they are proved and illustrated.* In this point of view, the study of several branches of mathematical science, however abstruse they may at first sight appear, will afford a high degree of gratification to the mind. When it is announced as a proposition in geometry, "that the square described on the hypothenuse, or longest side of a right-angled triangle, is equal to the sum of the squares described on the other sides,"*—it is pleasing to perceive how every step of the

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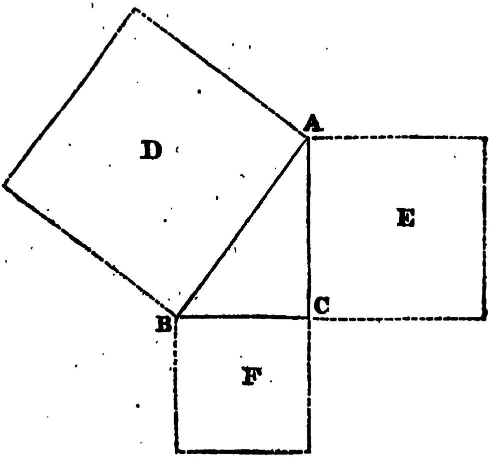
* The following figure will convey an idea to the unlearned reader of the meaning of this proposition.



demonstration proceeds with unerring certainty, and leads the mind to perceive the truth of the conclusion to which it leads, with as high a degree of demonstrative evidence as that 3 added to 6 make 9, or that 5 multiplied by 4 make 20. In like manner, when it is clearly demonstrated by mathematical reasoning, that "the three angles of every triangle, whatever be its size or the inclination of its sides, are exactly equal to two right angles, or 180 degrees," and that "the sides of a plane triangle are to one another as the sines of the angles opposite to them," the utility and importance of these truths may not at first view be appreciated, however convincing the evidence from which the conclusions are deduced. But when the student comes to know that on these demonstrated properties of a triangle depends the mode of measuring the height of mountains, and the breadth of rivers,—of determining the circumference of the earth, the distance of the sun and moon, the magnitudes of the planets, and the dimensions of the solar system,—it cannot but afford a positive gratification to perceive the important bearings of such truths, and that the astronomer, when he announces his sublime deductions respecting the sizes and distances of the heavenly bodies, does not rest on vague conceptions, but on observations conducted with the nicest accuracy, and on calculations founded on principles susceptible of the strictest demonstration.

"To follow a demonstration of a grand mathematical truth," says a powerful and enlightened writer,—"to per-

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ABC is a right-angled triangle, having the right angle at C, and AB is the hypothenuse, or longest side. By geometrical reasoning it can be demonstrated, that the square D, described on the longest side AB, is exactly equal to the sum of the squares E and F, described on the other two sides.--One of the uses of this proposition will appear from the following example. Suppose AC the height of a wall = 24 feet, BC the width of a trench = 18 feet; it is required to find the length of a ladder BA which will reach from the outside of the trench to the top of the wall. The square of 18 is 324, the square of 24 is 576, which added together make 900, equal to the square D; the square root of which is 30 = the length of the ladder. On this principle we can find the height of the mountains in the moon, when the length of their shadows is known.

ceive how clearly and how inevitably one step succeeds another, and how the whole steps lead to the conclusion, —to observe how certainly and unerringly the reasoning goes on from things perfectly self-evident, and by the smallest addition at each step, every one being as easily taken after the one before as the first step of all was, and yet the result being something, not only far from self-evident, but so general and strange that you can hardly believe it to be true, and are only convinced of it by going over the whole reasoning,—this operation of the understanding, to those who so exercise themselves, always affords the highest delight."

It is likewise a source of enjoyment to contemplate the experiments by which the doctrines of science are supported, and the reasonings and deductions founded on experimental investigations. When a person is told that the atmosphere presses on every part of the surface of the earth with a force equal to two thousand one hundred and sixty pounds on every square foot, it must surely be gratifying to behold a column of water supported in a glass tube, open at the lower end,—and a square bottle connected with an air-pump broken to pieces by the direct pressure of the atmosphere, —and from a comparison of the weight of mercury suspended in a tube with the diameter of its bore, to be able to calculate the atmospherical pressure on the body of a man, or even on the whole earth. When he is told that one ingredient of atmospheric air is the principle of flame, is it not curious and highly interesting to behold a piece of iron burning in this gas, throwing out brilliant sparks of white flame, and illuminating a large hall with a dazzling lustre? —and when he is informed that fixed air is the heaviest of the gases, and destructive to flame and animal life,—is it not gratifying to perceive this invisible fluid poured from one vessel to another, and when poured on the flame of a candle that it instantly extinguishes it? Many of the deductions of natural science are so wonderful, and so unlike every thing we should have previously conceived, that to the untutored mind they appear almost incredible, and little short of unfounded and extravagant assertions. When such a one is told that "any quantity of liquid, however small, will counterpoise any quantity, however great,"—that the rubbing of a glass cylinder against a cushion will produce the effect of setting fire to spirits of wine, or of bursting a bladder of air at the distance of a hundred feet from the machine—that the galvanic agency will produce a violent and uncommon effect upon the nervous and muscular system—and that in certain vegetable infusions, myriads of animals, of various forms, may be seen a thousand times less than the smallest visible point—such assertions are apt to stagger his belief as improbable and extravagant. But when he actually sees, in the first case, a large hogshead that would hold above a hundred gallons, filled with water, and a long tube whose bore is not half an inch in diameter, firmly inserted into its top, and a small quantity of water, scarcely exceeding a quart, poured into the tube—and then beholds the top rapidly swelling, and in a few moments, the whole cask burst to pieces and the water scattered in every direction,—or, in the second case, when he sees alcohol suddenly taking fire, and a bladder filled with oxygen and hydrogen gas exploding with a tremendous report, merely by the turning of the electrical machine at the other end of a long hall, and the interposition of a wire,—or when, in the third case, he sees a person drink a glass of porter which has a wire around it connected with a galvanic battery, and at a certain stage of the operation receive a tremendous concussion, which makes him start and roar like a madman,—or, in the last case, when he looks through a powerful microscope, and perceives hundreds of mites like so many young pigs, clambering among rocks of cheese, and thousands of fishes in a drop of water—such experimental illustrations of the truths of science cannot fail to prove highly satisfactory, and to afford no inconsiderable degree of entertainment and delight.

The occasional performance of scientific experiments, as opportunity offers, and *the construction of philosophical instruments*, may also be converted into a source of enjoyment. In the one case, the student of nature may derive gratification, in being the means of communicating entertainment and instruction to others; and in the other, he may whet his ingenuity, and increase his mental vigour, and be enabled, at a small expense, to gratify his curiosity in contemplating the various processes, and the beauties and sublimities of nature. Many of the instruments of science, when elegantly constructed, are beyond the reach of the general mass of mankind, on account of their expense; but a person of moderate reflection and ingenuity, during his leisure hours, can easily construct, at an inconsiderable expense, many of the most useful instruments which illustrate the facts of science. For example, a powerful compound microscope, capable of enabling us to perceive the most interesting minute objects in the animal, vegetable, and mineral kingdoms, may be constructed at an expense of little more than a crown, provided the individual constructs the tubes and other apparatus of pasteboard, wood, or other cheap materials; and the occasional exercise of the mental powers in such devices, so far from being irksome or fatiguing, is generally accompanied with satisfaction and pleasure.

It is true, indeed, that the study of some of the subjects above mentioned, particularly the first principles of the mathematics, may, in the outset, be attended with some difficulties, and to some minds may wear a dry and uninteresting aspect. But as the mind proceeds onward in its progress, and acquires clearer conceptions of what at first appeared difficult or obscure—every difficulty it is enabled to surmount gives a new relish to the subject of investigation, and additional vigour to the intellect, to enable it to vanquish the difficulties which still remain,—till at length it feels a pleasure and an interest in the pursuit, which no difficulties, nor even the lapse of time, can ever effectually destroy. "Let any man," says Lord Brougham, "pass an evening in vacant idleness, or even in reading some silly tale, and compare the state of his mind when he goes to sleep or gets up next morning, with its state some other day when he has passed a few hours in going through the proofs, by facts and reasonings, of some of the great doctrines in Natural Science, learning truths wholly new to him, and satisfying himself by careful examination of the grounds on which known truths rest, so as to be not only acquainted with the doctrines themselves, but able to show why he believes them, and to prove before others that they are true: he will find as great a difference as can exist in the same being,—the difference between looking back upon time unprofitably wasted, and time spent in self-improvement; he will feel himself in the one case listless and dissatisfied, in the other comfortable and happy; in the one case, if he do not appear to himself humbled, at least he will not have earned any claim to his own respect; in the other case, he will enjoy a proud consciousness of having by his own exertions become a wiser, and therefore a more exalted, creature."

The subjects to which I have now adverted may be considered, not merely in reference to the gratification they afford to the understanding, but likewise in reference to *the beneficial influence they would produce on the heart, and on social and domestic enjoyment.*

All the truths relative to the Creator's operations in the universe, when properly contemplated, are calculated to produce a powerful and interesting impression upon the affections. Is a person gratified at beholding *symmetry* and *beauty* as displayed in the works of art,—what a high degree of delightful emotion must be felt in surveying the beautiful arrangements of Infinite Wisdom, in the variety of forms, the nice proportions, the exquisite delicacy of texture, and the diversified hues which adorn the vegetable kingdom,—in the colours of the morning and evening clouds of a summer sky, the plumage of birds, the admirable workmanship on the bodies of insects, the fine polish of sea-shells, the variegated wavings and colouring of jaspers, topazes, and emeralds, and particularly in those specimens of Divine mechanism in insects, plants, and flowers, which the unassisted eye cannot discern, and which the microscope alone can unfold to view! Has he a taste for the *sublime?* How nobly is he gratified by an enlightened view of the nocturnal heavens, where suns unnumbered shine, and mighty worlds run their solemn rounds! Such contemplations have a natural tendency, in combination with Christian principles and motives, to *raise the affections* to that Almighty Being who is the uncreated source of all that is sublime and beautiful in creation,—to enkindle the fire of *devotion*,—to excite *adoration* of his infinite excellences, and to produce *profound humility* in his presence. Such studies likewise tend to preserve the mind in calmness and *serenity* under the moral dispensations of Him whose wisdom is displayed in all his arrangements, and whose "tender mercies are over all his works,"—and to inspire it with *hope* and confidence in relation to the future scenes of eternity, from a consideration of his power, benevolence, and intelligence, as displayed throughout the universe, and of the inexhaustible sources of felicity he has it in his power to distribute among numerous orders of beings throughout an immortal existence. Contemplating the numerous displays of Divine munificence around us—the diversified orders of delighted existence that people the air, the waters, and the earth, the nice adaptation of their organs and faculties to their different situations and modes of life, the ample provision made for their wants and enjoyments, and the boundless dimensions of the Divine empire, where similar instances of beneficence are displayed—the heart is disposed to rest with confidence on Him who made it, convinced that his Almighty power qualifies him to make us happy by a variety of means of which we have no adequate conception, and that his faithfulness and benevolence dispose him to withhold no real good "from them that walk uprightly."

Such studies would likewise tend *to heighten the delights of social enjoyment.* There is nothing more grating to the man of intelligence than the foolish and trifling conversation which prevails in the various intercourses of social life, even among the middling and the higher circles of society, and in convivial associations. The ribaldry and obscenity, the folly and nonsense, and the laughter of fools which too frequently distinguish such associations, are a disgrace to our civilized condition, and to our moral and intellectual nature. Without supposing that it will ever be expedient to lay aside cheerfulness and rational mirth, the lively smile, or even the loud laugh, it is surely conceivable, that a more rational and improving turn might be given to general conversation than what is frequently exemplified in our social intercourses. And what can we suppose better calculated to accomplish this end than the occasional introduction of topics connected with science and general knowledge, when all, or the greater part, are qualified to take a share in the general conversation? It would tend to stimulate the mental faculties, to suggest useful hints, to diffuse general information, to improve science and art, to excite the ignorant to increase in knowledge, to present interesting objects of contemplation, to enliven the spirits, and thus to afford a source of rational enjoyment. It would also have a tendency to prevent those shameful excesses, noisy tumults, and scenes of *intemperance* which so frequently terminate our festive entertainments. For want of qualifications for such conversation, cards, dice, childish questions and amusements, gossiping chit-chat, and tales of scandal are generally resorted to, in order to consume the hours allotted to social enjoyment. And how melancholy the reflection, that rational beings capable of investigating the laws and phenomena of the universe, and of prosecuting the most exalted range of thought, and who are destined to exist in other worlds, throughout an endless duration—should be impelled to resort to such degrading expedients, to wheel away the social hours!

Domestic enjoyment might likewise be heightened and improved by the studies to which we have adverted. For want of qualifications for rational conversation, a spirit of listlessness and indifference frequently insinuates itself into the intercourses of families, and between married individuals, which sometimes degenerates into fretfulness and impatience, and even into jars, contentions, and violent altercations; in which case there can never exist any high degree of affection or domestic enjoyment. It is surely not unreasonable to suppose, that were the minds of persons in the married state possessed of a certain portion of knowledge, and endowed with a relish for rational investigations—not only would such disagreeable effects be prevented, but a variety of positive enjoyments would be introduced. Substantial knowledge, which leads to the proper exercise of the mental powers, has a tendency to meliorate the temper, and to prevent those ebullitions of passion, which are the results of vulgarity and ignorance. By invigorating the mind, it prevents it from sinking into peevishness and inanity. It affords subjects for interesting conversation, and augments affection by the reciprocal interchanges of sentiment and feeling, and the mutual communication of instruction and entertainment. And in cases where malignant passions are ready to burst forth, rational arguments will have a more powerful influence in arresting their progress, in cultivated minds, than in those individuals in whose constitution animal feeling predominates, and reason has lost its ascendency. As an enlightened mind is generally the seat of noble and liberal sentiments—in those cases where the parties belong to different religious sectaries, there is more probability of harmony and mutual forbearance being displayed, when persons take an enlarged view of the scenes of creation, and the revelations of the Creator, than can be expected in the case of those whose faculties are immersed in the mists of superstition and ignorance.

How delightful an enjoyment is it, after the bustle of business and the labours of the day are over,—when a married couple can sit down at each corner of the fire, and, with mutual relish and interest, read a volume of history or of popular philosophy, and talk of the moral government of God, the arrangements of his providence, and the wonders of the universe! Such interesting conversations and exercises beget a mutual esteem, enliven the affections, and produce a friendship lasting as our existence, and which no untoward incidents can ever effectually impair. A Christian pastor, in giving an account of the last illness of his beloved partner, in a late periodical work, when alluding to a book she had read along with him about two months before her decease, says, "I shall never forget the pleasure with which she studied the illustrations of the Divine perfections in that interesting book. Rising from the contemplation of the variety, beauty, immensity, and order of the creation, she exulted in the assurance of having the Creator for her father, anticipated with great joy the vision of him in the next world, and calculated with unhesitating confidence on the sufficiency of his boundless nature to engage her most intense interest, and to render her unspeakably happy for ever. It is well known that the late lamented *Princess Charlotte* and her consort Prince Leopold lived together in the greatest harmony and affection; and from what her biographers have stated respecting her education and pursuits, it appears that the mutual friendship of these illustrious individuals was heightened and cemented by the rational conversation in which they indulged, and the elevated studies to which they were devoted. Her course of education embraced the English, classical, French, German, and Italian languages; arithmetic, geography, astronomy, the first six books of Euclid, algebra, mechanics, and the principles of optics and perspective, along with history, the policy of governments, and particularly the principles of the Christian religion. She was a skilful musician, had a fine perception of the picturesque in nature, and was fond of drawing. She took great pleasure in strolling on the beach, in marine excursions, in walking in the country, in rural scenery, in conversing freely with the rustic inhabitants, and in investigating every object that seemed worthy of her attention. She was an enthusiastic admirer of the grand and beautiful in nature, and the ocean was to her an object of peculiar interest. After her union with the prince, as their tastes were similar, they engaged in the same studies. Gardening, drawing, music, and rational conversation diversified their leisure hours. They took great pleasure in the culture of flowers—in the classification of them—and in the formation, with scientific skill, of a *hortus siccus*. But the library, which was furnished with the best books in our language, was their favourite place of resort; and their chief daily pleasure, mutual instruction. They were seldom apart either in their occupations or in their amusements; nor were they separated in their religious duties. "They took sweet counsel together, and walked to the house of God in company;" and it is also stated, on good authority, that they had established the worship of God in their family, which was regularly attended by every branch of their household. No wonder, then, that they exhibited an auspicious and a delightful example of private and domestic virtue, of *conjugal attachment*, and of unobtrusive charity and benevolence. In the higher circles of society, as well as in the lower, it would be of immense importance to the interests of domestic happiness, that the taste of the Princess Charlotte was more closely imitated, and that the fashionable frivolity and dissipation which so generally prevail were exchanged for the pursuits of knowledge, and the delights of rational and improving conversation. Then those family feuds, contentions, and separations, and those prosecutions for matrimonial infidelity which are now so common, would be less frequently obtruded on public view; and examples of virtue, affection, and rational conduct would be set before the subordinate ranks of the community, which might be attended with the most beneficial and permanent results, not only to the present, but to future generations.

In short, the possession of a large store of intellectual wealth would fortify the soul in the prospect of every evil to which humanity is subjected, and would afford consolation and solace when fortune is diminished, and the greater portion of external comforts is withdrawn. Under the frowns of adversity, those worldly losses and calamities which drive unthinking men to desperation and despair would be borne with a becoming magnanimity; the mind having within itself the chief resources of its happiness, and becoming almost independent of the world around it. For to the individual whose happiness chiefly depends on intellectual pleasures, retirement from general society and the bustle of the world is often the state of his highest enjoyment.

Thus I have endeavoured briefly to illustrate the enjoyments which a general diffusion of knowledge would produce—from a consideration of the limited conceptions of the untutored mind, contrasted with the ample and diversified range of view presented to the enlightened understanding—from the delightful tendency of scientific pursuits, in enabling us to trace, from a single principle, an immense variety of effects, and surprising and unexpected resemblances, where we least expected to find them,—from the grand and sublime objects it presents before us—from the *variety* of novel and interesting scenes which the different departments of physical science unfold—from the exercise of tracing the steps by which scientific discoveries have been made—and from the influence of such studies on the affections and on social and domestic enjoyment.

For want of the knowledge to which I have alluded, it happens that few persons who have been engaged in commercial or agricultural pursuits feel much enjoyment, when, in the decline of life, they retire from the active labours in which they had been previously engaged. Retirement and respite from the cares of business afford them little gratification, and they feel a vacuity within which nothing around them or within the range of their conceptions can fill up. Being destitute of a taste for intellectual pursuits, and devoid of that *substratum* of thought which is the ground-work of mental activity and of rational contemplation, they enjoy nothing of that mental liberty and expansion of soul which the retreats of solitude afford to the contemplative mind; and, when not engaged in festive associations, are apt to sink into a species of listlessness and *ennui*. They stalk about from one place to another without any definite object in view—look at every thing around with a kind of unconscious gaze—are glad to indulge in trifling talk and gossip with every one they meet—and, feeling how little enjoyment they derive from their own reflections, not unfrequently slide into habits of sensuality and intemperance.

From what we have stated on this topic, it evidently appears that the pursuits of science are fitted to yield a positive gratification to every rational mind. It presents to view processes, combinations, metamorphoses, motions, and objects of various descriptions calculated to arrest the attention and to astonish the mind, far more than all the romances and tales of wonder that were ever invented by the human imagination. When the pleasures arising from such studies are rendered accessible to all, human happiness will be nearly on a level, and the different ranks of mankind will enjoy it nearly in an equal degree. As true enjoyment depends chiefly on the state of the mind, and the train of thought that passes through it, it follows, that when a man prosecutes a rational train of thought, and finds a pleasure in the contemplation of intellectual objects, his happiness is less dependent on mere sensitive enjoyments, and a smaller portion of external comforts will be productive of enjoyment than in the case of those whose chief pleasure consists in sensual gratifications. When intellectual pursuits, therefore, shall occupy the chief attention of mankind, we may indulge the hope, that those restless and insatiable desires which avarice and ambition never cease to create will seldom torment the soul, and that a noble generosity of mind in relation to riches will distinguish persons of every rank, and be the means of producing enjoyment wherever its influence extends.

SECTION V.

On the Practical Influence of Scientific Knowledge, and its tendency to promote the external comforts of general society.

In the preceding section I have considered the beneficial tendency of knowledge and the pleasure it affords, chiefly in reference to the understanding and the affections. In the present section I shall consider it more particularly, in regard to its *practical effects* on the active employments and the external comforts of the middling and lower orders of the community.—Every art, being founded on scientific principles, and directed in its operations by the experimental deductions of philosophy, it follows, that a knowledge of the principles of science must be conducive to a *skilful* practice of the arts, and must have a tendency to direct the genius of the artist to carry them to their highest pitch of improvement. In illustrating this topic, I shall endeavour to show that an acquaintance with science would render mechanics, manufacturers, and labourers more expert and skilful in their different departments—would pave the way for future discoveries and improvements—and that the knowledge and spirit which produced such improvements would promote the external comforts of mankind.

I. A knowledge of the principles of science would render manufacturers, mechanics, and common labourers of all descriptions more skilful in their respective professions and employments.

In the arts of *dying* and *calico printing*, every process is conducted on the principles of chymistry. Not a colour can be imparted but in consequence of the affinity which subsists between the cloth and the die,—or the die and the mordant employed as a bond of union between them; and the colours will be liable to vary, unless the artist take into account the changes which take place in them by the absorption of oxygen;—a knowledge of which and of the different degrees of oxydizement which the several dies undergo, requires a considerable portion of chymical skill; and such knowledge is absolutely necessary to enable either the dier or the calico printer to produce in all cases permanent colours of the shade he intends. To chymistry, too, they must be indebted for the knowledge they may acquire of the nature of the articles they use in their several processes—for the artificial production of their most valuable mordants—and for some of their most beautiful and brilliant colours. As an evidence of this, it is sufficient to state, that, to produce such colours as an olive ground and yellow figures, a scarlet pattern on a black ground, or a brown ground with orange figures, formerly required a period of many weeks; but by means of chymical preparations, the whole of this work may now be done in a few days, and patterns more delicate than ever produced, with a degree of certainty of which former manufacturers could have no idea; and all this is effected by dying the cloth a self-colour in the first instance, and afterward merely printing the pattern with a chymical preparation, which discharges a part of the original die, and leaves a new colour in its stead.

The art of *bleaching* has likewise received so many important improvements from chymical science, that no one is now capable of conducting its processes to advantage who is ignorant of the scientific principles on which the present practice of that art is founded. Till about the close of the eighteenth century, the old *tedious* process of bleaching continued in practice. But, about that period the introduction of the *oxymuriatic acid*, combined with alkalis, lime and other ingredients, in bleaching cottons and linens, has given an entirely new turn to every part of the process, so that the process which formerly required several months for its completion can now be accomplished in a few days, and with a degree of perfection which could not previously be attained. Even in a few hours, that which formerly required nearly a whole summer, can now be effected, and that, too, merely by the action of an almost *invisible* fluid. As the whole process of bleaching, as now practised, consists almost entirely of chymical agents and operations, every person employed in this art ought to possess a certain portion of chymical knowledge, otherwise many of its processes would run the risk of being deranged, and the texture of the materials undergoing the process of being either materially injured or completely destroyed.

The operation of *brewing* fermented liquors is likewise a chymical process. The student of chymistry will learn how the barley in the first instance is converted into a saccharine substance by malting; how the fermentative process converts the saccharine to a spirituous substance; and how the latter, by continuing the process, becomes changed into vinegar. He will also learn the means of promoting and encouraging this process, and how to retard and check it, when it is likely to be carried too far, so as to be sure of uniformly obtaining satisfactory results. In this and in every other process, it must therefore be of importance to acquire some knowledge of the principles of natural substances, and of the nature of those changes which take place in the materials on which we operate. In the *manufacture of soap*, it is reckoned by those intimately acquainted with the process, that many thousands per annum, now lost to the community, might be saved, were the trade carried on upon scientific principles. When a soap-boiler is an accomplished chymist, he knows how to analyze barilla, kelp, potass, and other materials, so as to ascertain the proportion of alkali in each; and when these articles are at an exorbitant price, he will have recourse to various residuums, which he will decompose by chymical means, and use as substitutes. He will know how to oxydize the common oils and oil-dregs, so as to give them consistence, and render them good substitutes for tallow—and how to apportion his lime so as to make his alkali perfectly caustic, without using an unnecessary quantity of that article. The *manufacture of candles* might also derive advantage from chymical science. It is found that foreign tallows frequently contain a large portion of acid rendering them inferior to the English, which by chymical means may be purified at a very small expense, and by the proper application of chymical agents, other brown tallows may be rendered beautifully white, and fit for the best purposes.*

The *tanning* of hides is now ascertained to consist in impregnating the animal matter with that peculiar principle taken from the vegetable kingdom, called *tan*, the effect of which is explained entirely on chymical principles. It is now known that many substances besides oak-bark, contain tan, and to chymistry we are indebted for the means of discovering with accuracy the quantity of tan which the several astringent vegetables contain. It is supposed not to be improbable, when the manufacturers shall have paid proper attention to chymical science, that the article in question may be prepared in chymical laboratories, so as entirely to supersede the use of oak-bark, since the principle of tannin has already been formed *artificially* by a modern chymist.*—It is also well known, that to chymical research, the manufacturers of *earthenware* and *porcelain* are indebted for the improved state in which they are now found. For, the successful management of all their branches, from the mixture of the materials which form the body of the ware, to the production of those brilliant colours with which such articles are adorned—is dependant on the principles of chymical science. The celebrated Wedgwood, to whom this branch of manufacture is so highly indebted, devoted his whole attention to the improvement of his art by the application of his chymical knowledge, of which few men possessed a larger share; and he has been heard to declare, "that nearly all the diversified colours applied to his pottery were produced only by the oxides of iron."

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* For most of the above hints the author is indebted to Mr. Parkes.

There are few persons to whom a knowledge of chymistry is of more importance than to the *agriculturalist*. It will teach him to analyze the soils on the different parts of his farm, and to subject to experiment the peat, the marle, the lime, and other manures, in order to ascertain the advantages to be derived from them, and the propriety of applying them in particular instances. It will teach him when to use lime hot from the kiln, and when slacked, how to promote the putrefactive process in his composts, and at what period to check it, so as to prevent the fertilizing particles becoming unprolific and of little value. It will also teach him the difference in the properties of marle, lime, dung, mud, ashes, alkaline salt, soap-waste, sea-water, and other manures, and, consequently, which to prefer in all varieties of soil. It is said that the celebrated Lavoisier cultivated 240 acres of land in La Vendee, on chymical principles, in order to set a good example to the farmers; and his mode of culture was attended with so much success that he obtained a third more of crop than was procured by the usual method, and in nine years his annual produce was doubled.

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* Seguin. See Nicolson's Phil. Journal, 4to. vol. i. p. 271.

I might also have illustrated the practical advantages of chymical science in relation to the *art of extracting metals from their ores*,—the conversion of iron into steel, and the metallic ore into malleable iron—*the manufacture of glass, alum, copperas, blue vitriol, soda, potash, morocco leather, paper, starch, varnish*, and *Prussian-blue*—the *refining of sugar, saltpetre, gold, and silver*—the artificial *formation of ice*—the *method of preserving* fish, meat, and other articles of food, and various other processes connected with the practical departments of life, all of which are strictly chymical operations, and can be improved and brought to perfection chiefly by the knowledge and application of the doctrines and facts of chymical science.

With regard to the professions of the *physician, surgeon*, and *apothecary*, it is now universally admitted, that an extensive acquaintance with the principles and facts of chymistry is essentially requisite to the successful practice of these arts. The human body may be considered as a species of *laboratory*, in which the various processes of absorption, secretion, fermentation, composition, and decomposition are incessantly going forward. Every article of food and drink we throw into the stomach, every portion of atmospheric air we receive into the lungs, every impression we derive from the surrounding elements, every motion of the heart and lungs, and every pulse that vibrates within us, may be considered as effecting a chymical change in the vital fluids, and in every part of the animal system; the nature of which it is of the utmost importance to the medical practitioner thoroughly to investigate and understand. For, how can he be supposed to be successful in his attempts to counteract the disorders to which the human frame is incident, and to produce a chymical effect on the constitution of his patient, if he is ignorant either of the processes which are going on in the system, of the chymical properties of the substances which he throws into it, or of the effects which they will certainly produce? If he is ignorant of the chymical affinities that subsist between the various articles of the materia medica, he may often administer preparations which are not only inefficacious, but even poisonous and destructive to his patient. When two chymical substances, each of which might be administered *separately* with safety, are combined, they sometimes produce a substance which is highly deleterious to the animal system. For example, although *mercury* and *oxygenized muriatic acid* have both been administered, and either of them may be taken separately without injury to the animal economy,—yet, if a medical practitioner, ignorant of the chymical affinities of such substances, and of the quality of the compound, should give both of them in conjunction, the most dreadful consequences might ensue; since the product of this mixture, *oxygenized muriate of mercury*, is known to be a most corrosive poison; and there can be little doubt that hundreds of lives have been destroyed by ignorant pretenders to medical science, in consequence of the injudicious administration of such deleterious preparations.

But chymistry is not the only science which is of utility in the arts which minister to the comfort and pecuniary interests of society. Geometry, trigonometry, conic sections, and other branches of mathematical knowledge; hydrostatics, hydraulics, mechanics, optics, botany, mineralogy and the other departments of the physical sciences, may be rendered of essential service to artisans and mechanics of various descriptions. All the sciences are, in some degree, connected, and reflect a mutual light upon one another; and consequently the man who has the most extensive acquaintance with science is best qualified for carrying to perfection any one department of the useful arts.

Practical geometry is highly useful to almost every mechanic and artisan, particularly to millwrights, bricklayers, carpenters, and masons. It teaches them to form angles of any assigned number of degrees, to draw parallel and perpendicular lines, to proportion circumferences to diameters, to divide circular rims into any number of parts, to estimate the square or cubical contents of any piece of workmanship, and to calculate the price they ought to receive for any work they perform, according to its solid or superficial dimensions. In forming estimates of the expense of any proposed undertaking, the carpenter, bricklayer, and architect must find such knowledge essentially requisite; and even the common labourer, who undertakes the formation of roads, the digging of pits, and the clearing away of rubbish, will find the principles of arithmetic and geometry of important service in estimating the rate at which he can perform such operations. The following geometrical theorems, besides many others, are capable of a variety of practical applications, in many departments of the arts. "If, from the two ends of any diameter of the circle two lines be drawn to meet in any one point of the circle whatever, such lines are perpendicular to each other," or, in other words, they form a right angle at the point of contact.* Again, "The areas of all circles are in exact

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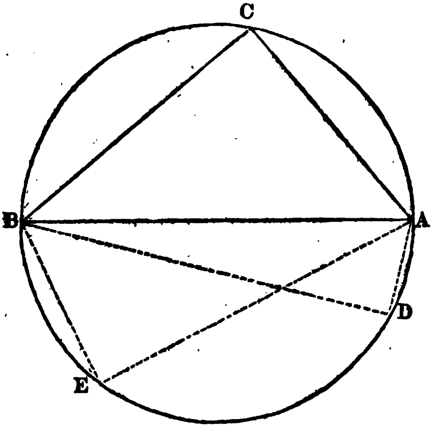
* For example, if from the two ends of the diameter A and B, the lines AC BC be drawn to the point C, these lines will be perpendicular to each other, and consequently the angle at C will be a right angle. In like manner the lines AD and BD, AB and BE, will stand at right angles to each other; and the same will be the case to whatever point of the circle such lines



proportion to the squares of their radii, or half-diameters."* If, for example, we draw a circle with a pair of compasses whose points are stretched 4 inches asunder, and another with an extent of eight inches, the large circle is exactly *four times* the size or area of the small one. For the square of 4 is = 16, and the square of 8 is = 64, which is four times 16. And as the circumferences of the circles are in proportion to the radii, it will follow, that the length of a string which would go round the curve of the larger circle is exactly *double* the length of one which would go round the lesser. Mechanics, in recognising such theorems, will meet with many opportunities of reducing them to practice. Again, there is a figure which geometricians term a *parabola*, which is formed every time we pour water forcibly from the mouth of a tea-kettle, or throw a stone forward from the hand. One property of the parabola is, that if a spout of water be directed at half a perpendicular from the ground, or at an angle of elevation of 45 degrees, it will come to the ground at a greater distance than if any other direction had been given it, a slight allowance being made for the resistance of the air. Hence the man who guides the pipe of a fire-engine may be directed how to throw the water to the greatest distance, and he who aims at a mark, to give the projectile its proper direction. To surveyors, navigators, land-measurers, gaugers, and engineers, a knowledge of the mathematical sciences is so indispensably requisite, that without it such arts cannot be skilfully exercised.

The *physical sciences* are also of the greatest utility in almost every department of art. To masons, architects, ship-builders, carpenters, and every other class employed in combining materials, raising weights, quarrying stones, building piers and bridges, splitting rocks, or pumping water from the bowels of the earth,—a knowledge of the principles of *mechanics* and *dynamics* is of the first importance. By means of these sciences the nature of the lever and other mechanical powers may be learned, and their

are drawn. The practical application of this principle, in various operations, will at once be obvious to the intelligent mechanic, especially when he intends the two ends or sides of any piece of machinery to stand perpendicular to each other.

forces estimated—the force produced by any particular combination of these powers calculated—and the best mode of applying such forces to accomplish certain effects ascertained. By a combination of the mechanical powers the smallest force may be multiplied to an almost indefinite extent, and with such assistance man has been enabled to rear works and to perform operations which excite astonishment, and which his own physical strength, assisted by all that the lower animals could furnish, would have been altogether inadequate to accomplish. An acquaintance with the experiments which have been made to determine *the strength of materials*, and the results which have been deduced from them, is of immense importance to every class of mechanics employed in engineering and architectural operations. From such experiments (which have only been lately attended to on scientific principles) many useful deductions might be made respecting the best form of mortises, joints, beams, tenons, scarphs, &c.; the art of *mast-making*, and the manner of disposing and combining the strength of different substances in naval architecture, and in the rearing of our buildings. For example,—from the experiments now alluded to it has been deduced, that the strength of any piece of material *depends chiefly on its depth*, or on that dimension which is in the direction of its strain. A bar of timber of one inch in breadth and two inches in depth is *four times* as strong as a bar of only one inch deep: and it is *twice* as strong as a bar two inches broad and one deep, that is, a joint or lever is always strongest when laid on its edge. Hence it follows, that the strongest joist that can be cut out of a round tree is not the one which has the greatest quantity of timber in it, but such that the product of its breadth by the square of its depth shall be the greatest possible. Again, from the same experiments it is found, that *a hollow tube is stronger than a solid rod containing the same quantity of matter.* This property of hollow tubes is also accompanied with greater stiffness; and the superiority in strength and stiffness is so much the greater as the surrounding shell is thinner in proportion to its diameter. Hence we find that the bones of men and other animals are formed hollow, which renders them incomparably stronger and stiffer, gives more room for the insertion of muscles, and makes them lighter and more agile, than if they were constructed of solid matter. In like manner, the bones of birds, which are thinner than those of other animals, and the quills in their wings, acquire by their thinness the strength which is necessary, while they are so light as to give sufficient buoyancy to the animal in its flight through the aerial regions. Our engineers and carpenters have of late begun to imitate nature in this respect, and now make their axles and other parts of machinery hollow, which both saves a portion of materials and renders them stronger than if they were solid.*

The departments of *hydrostatics* and *hydraulics*, which treat of the pressure and motion of fluids, and the method of estimating their velocity and force, require to be thoroughly understood by all those who are employed in the construction of common and forcing pumps, water-mills, fountains, fire-engines, hydrostatical presses; and in the formation of canals, wet-docks, and directing the course of rivers; otherwise they will constantly be liable to commit egregious blunders, and can never rise to eminence in their respective professions. Such principles as the following:—that fluids press equally in all directions,—that they press as much *upwards* as *downwards*—that water, in several tubes that communicate with each other, will stand at the same height in all of them, whether they be small or great, perpendicular or oblique,—that the pressure of fluids is directly as their *perpendicular height*, without any regard to their quantity,—and that the quantities of water discharged at the same time by different apertures, under the same height of surface in the reservoir, are to each other nearly as the areas to their apertures,—will be found capable of extensive application to plumbers, engineers, pump-makers, and all who are employed in conducting water over hills or valleys, or in using it as a mechanical power, by a recognition of which they will be enabled to foresee, with certainty, the results to be expected from their plans and operations; for want of which knowledge many plausible schemes have been frustrated, and sums of money expended to no purpose.

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* The mechanical reader who wishes particular information on this subject is referred to the article *Strength of Materials* in *Ency. Brit.* 3d edit., which was written by the late Professor Robison.

The following figures and explanations will tend to illustrate some of the principles now stated:—1. Fluids press in proportion to their *perpendicular heights*, and the base of the vessel containing them, without regard to the quantity. Thus,

Fig. 1.

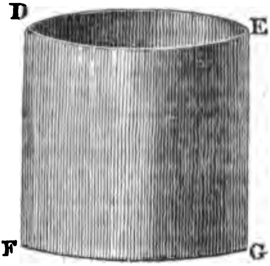


Fig. 2

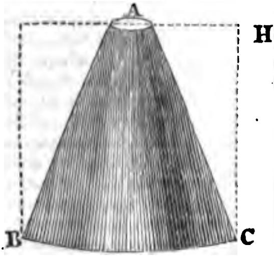
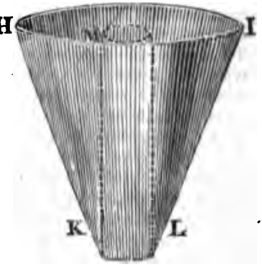


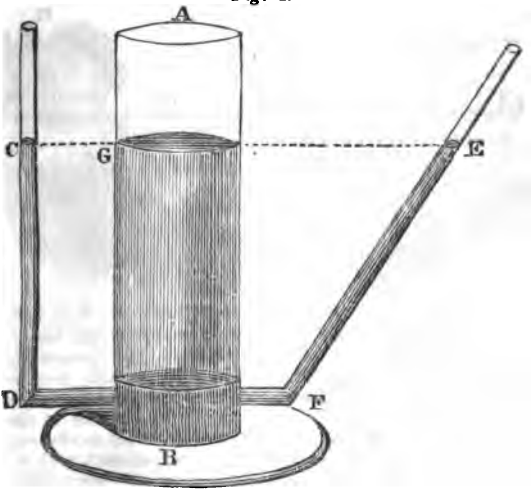
Fig. 3.



if the vessel ABC, *Fig.* 2, has its base BC equal to the base FG of the cylindrical vessel DEFG, *Fig.* 1, but is much smaller at the top A than at the bottom, and of the same height; the pressure upon the bottom BC is *as great* as the pressure upon the bottom of the vessel DEFG, when they are filled with water, or any other liquid, notwithstanding that there will be a much greater quantity of water in the cylindrical than in the conical vessel; or, in other words, the bottom BC will sustain a pressure equal to what it would be if the vessel were as wide at the top as at the bottom. In like manner, the bottom of the vessel HIKL, *Fig*. 3, sustains a pressure only equal to the column whose base is KL, and height KM, and not as the whole quantity of fluid contained in the vessel; all the rest of the fluid being supported by the sides. The demonstration of these positions would occupy too much room, and to many readers would appear too abstract and uninteresting; but they will be found satisfactorily demonstrated in most books which treat of the doctrines of hydrostatics.

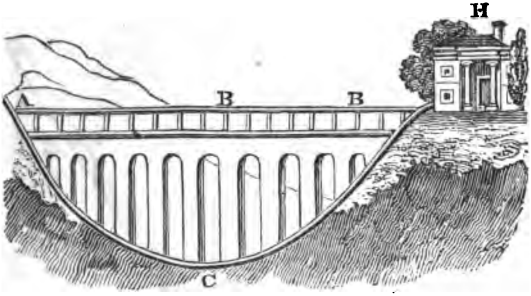
2. The positions now stated form the foundation of the hydrostatical paradox, namely, "that a quantity of fluid, however small, may be made to counterpoise a quantity however great." Thus, if to a wide vessel AB we attach a tube CD, communicating with the vessel, and pour water into it, the water will run into the larger vessel AB, and will stand at the same height C and G in both. If we affix an inclined tube EF, likewise communicating with the large vessel, the water will also stand at E at the same height as in the other two; the perpendicular altitude being the same in all the three tubes, however small the one may be in proportion to the other. This experiment clearly proves that the small column of water balances and supports the large column, which it could not do if the lateral pressures at bottom were not equal to each other. Whatever be the inclination of the tube EF, still the perpendicular altitude will be the same as that of the other tubes, although the column of water must be much longer than those in the upright tubes. Hence it is evident, that a small quantity of a fluid may, under certain circumstances, counterbalance any quantity of the same fluid. Hence also the truth of the principle in hydrostatics, that "*in tubes which have a communication, whether they be equal or unequal, short or oblique, the fluid always rises to the same height.*" From these facts it follows, that water cannot be conveyed by means of a pipe that is laid in a reservoir to any place that is higher than the reservoir.

Fig. 4.



These principles point out the mode of conveying water across valleys without those expensive aqueducts which were erected by the ancients for this purpose. A pipe, conforming to the shape of the valley, will answer every purpose of an aqueduct. Suppose the spring at A, *Fig.* 5, and water is wanted on the other side of the valley to supply the house H, a pipe of lead or iron laid from the spring-head across the valley will convey the water up to the level of the spring-head; and if the house stand a little lower than the spring-head, a constant stream will pour into the cisterns and ponds where it is required, as if the house had stood on the other side of the valley; and, consequently, will save the expense of the arches BB, by which the ancient Romans conducted water from one hill to another. But, if the valley be very deep, the pipes must be made very strong near its bottom, otherwise they will be apt to burst; as the pres-

Fig. 5.



sure of water increases in the rapid ratio of 1, 3, 5, 7, 9, &c. and is always in proportion to its perpendicular height.

3. Fluids *press in all directions*, laterally and upwards, as well as downwards. That fluids press *laterally* may be seen by boring a hole in the side of a cask containing any liquid, when the liquid will run out in consequence of the lateral pressure. The *upward* pressure is not so obvious, but is clearly proved by the following experiment, with an instrument generally termed the hydrostatic bellows:—This machine consists of two thick oval boards, about 18 inches long and 16 inches broad, united to each other by leather, so as to open and shut like a pair of common bellows, but without valves. Into this instrument a pipe B, several feet high, is fixed at D. If we pour water into the pipe at its top C it will run into the bellows and separate the boards a little. If we then lay three weights, each weighing 100 pounds, upon the upper board, and pour more water into the pipe, it will run into the bellows, and raise up the board with all the weights upon it. And though the water in the tube should weigh in all only a quarter of a pound, yet the pressure of this small force upon the water below in the bellows shall support the weights, which are 300 pounds; nor will they have weight enough to make them descend, and conquer the weight of water, by forcing it out of the mouth of the pipe. The reason of this will appear from what has been already stated respecting the pressure of

Fig. 6.

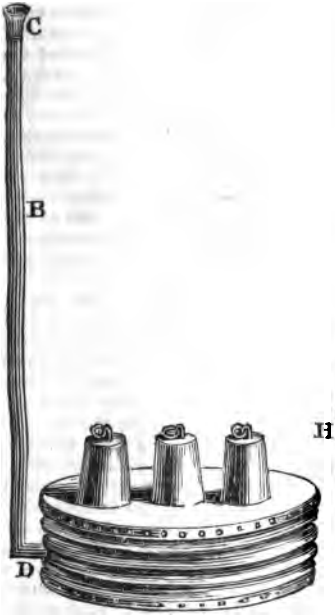
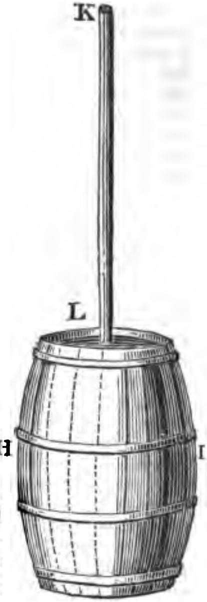


Fig. 7.



fluids of equal heights, without any regard to the quantities. For, if a hole be made in the upper board, and a tube be put into it, the water will rise in the tube to the same height that it does in the pipe; and it would rise as high (by supplying the pipe) in as many tubes as the board would contain holes. Hence, if a man stand upon the upper board, and blow into the bellows through the pipe, he will raise himself upward upon the board; and the smaller the bore of the pipe is the easier will he be able to raise himself.

And if he put his finger on the top of the pipe, he may support himself as long as he pleases.

The uses to which this power may be applied are of great variety and extent; and the branches of art dependent upon it appear to be yet in their infancy. By the application of this power the late Mr. Bramah formed what is called the *Hydrostatic Press*, by which a prodigious force is obtained, and by the help of which, hay, straw, wool, and other light substances may be forced into a very small bulk, so as to be taken in large quantities on board a ship. With a machine, on this principle, of the size of a tea-pot, standing before him on a table, a man is enabled to cut through a thick bar of iron as easily as he could clip a piece of pasteboard with a pair of shears. By this machine a pressure of 500 or 600 tons may be brought to bear upon any substances which it is wished to press, to tear up, to cut in pieces, or to pull asunder.

Upon the same principle, the tun or hogshead HI, *Fig.* 7, when filled with water, may be burst, by pressing it with some pounds additional weight of the fluid through the small tube KL, which may be supposed to be from 25 to 30 feet in height. From what has been already stated, it necessarily follows, that the small quantity of water which the tube KL contains presses upon the bottom of the tun with as much force as if a column of water had been added as wide as the tun itself, and as long as the tube, which would evidently be an enormous weight. A few years ago, a friend of mine, when in Ireland, performed this experiment to convince an English gentleman, who called in question the principle, and who laid a bet of fifty pounds that it would not succeed. A hogshead, above 3 feet high, and above 2 feet wide, was filled with water; a leaden tube, with a narrow bore, between 20 and 30 feet long, was firmly inserted into the top of the hogshead; a person, from the upper window of a house, poured in a decanter of water into the tube, and, before the decanter was quite emptied, the hogshead began to swell, and, in two or three seconds, burst into pieces, while the water was scattered about with immense force.

Hence, we may easily perceive what mischief may sometimes be done by a very small quantity of water, when it happens to act according to its perpendicular height. Suppose, that in any building, near the foundation, a small quantity of water, only of the extent of a square yard, has settled, and suppose it to have completely filled up the whole vacant space, if a tube of 20 feet long were thrust down into the water, and filled with water from above, a force of more than 5 tons would be applied to that part of the building, which would blow it up with the same force as gunpowder.* The same effect may sometimes be produced by rain falling into long narrow chinks, that may have inadvertently been left in building the walls of a house; which shows the importance of filling up every crevice and opening of a building, and rendering the walls as close and compact as possible. Hence, likewise, similar processes in nature, connected with pools of water in the bowels of the earth, may occasionally produce the most dreadful devastations. For, should it happen that, in the interior of a mountain, two or three hundred feet below the surface, a pool of water thirty or forty square feet in extent, and only an inch or two in depth, was collected, and a small crevice or opening of half an inch in breadth were continued from the surface to the water in the pool; and were this crevice to be filled with rain or melted snow, the parts around the layer of water would sustain a pressure of more than *six hundred tons*, which might shake the mountain to its centre, and even rend it with the greatest violence. In this way, there is every reason to believe, partial earthquakes have been produced, and large fragments of mountains detached from their bases.

The principles now illustrated are capable of the most extensive application, particularly in all engineering and hydraulic operations. It is on the principle of the lateral and upward pressure of fluids that the water, elevated by the New River water-works, in the vicinity of London, after having descended from a basin in a vertical pipe, and then, after having flowed horizontally in a succession of pipes under the pavement, is raised up again through another pipe, as high as the fountain in the Temple Garden. It is upon the same principle that a vessel may be filled either at the mouth or at the bottom indifferently, provided that it is done through a pipe, the top of which is as high as the top of the vessel to be filled. Hence, likewise, it follows, that when piers, aqueducts, or other hydraulic works for the retention of water, are to be constructed, it becomes necessary to proportion their strength to the lateral pressure which they are likely to sustain, which becomes greater in proportion to the height of the water to be sustained. Walls, likewise, designed to support terraces, ought to be sufficiently strong to resist the lateral pressure of the earth and rubbish which they are to sustain, since this pressure will be greater as the particles of earth of which the terraces are composed are less bound together, and in proportion as the terraces are more elevated. The increase of pressure in proportion to the depth of any fluid likewise shows the necessity of forming the sides of pipes or masonry in which fluids are to be retained, *stronger towards the bottom*, where the pressure is greatest. If they are no thicker than what is sufficient for resisting the pressure near the top, they will soon give way by the superior pressure near the bottom; and if they are thick enough in every part to resist the great pressure below, they will be stronger than necessary in the parts above, and, consequently, a superfluous expense, that might have been saved, will be incurred in the additional materials and labour employed in their construction. The same principle is applicable to the construction of flood-gates, dams, and banks of every description, for resisting the force of water. When the strength and thickness requisite for resisting the pressure at the greatest depth is once ascertained, the walls or banks may be made to taper upwards, according to a certain ratio founded on the strength of the materials, and the gradual decrease of pressure from the bottom upwards; or, if one side be made perpendicular, the other may proceed in a slanting direction towards the top.

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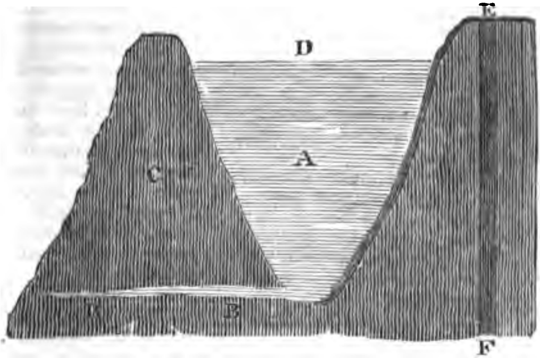
* See *Fig.* 8, p. 151.

From the principles and experiments now stated, we may also learn the reason why the banks of ponds, rivers, and canals *blow up*, as it is termed. If water can insinuate itself under a bank or dam, even although the layer of water were no thicker than a half-crown piece, the pressure of the water in the canal or pond will force it up. In *Fig.* 8, let A represent the section of a river or canal, and BB a drain running under one of its banks; it is evident, that if the bank C is not heavier than the column of water DB, that part of the bank must inevitably give way. This effect may be prevented in artificial canals by making the sides very tight with clay heavily rammed down, or by cut-

Fig. 8.



ting a trench EF, about a foot and a half wide, along the bank of the river or canal, and a little deeper than the bottom of the canal, which, being filled up with earth or clay well moistened with water, forms, when dry, a kind of wall through which the water cannot penetrate. By inattention to such circumstances many disasters have happened, and much expense needlessly incurred; and, therefore, the scientific principles to which I have now adverted ought to be known, even by labourers of the lowest rank employed in operations carried on for the improvement of the country.

To the want of a recognition of these principles may be attributed the failure of the following scheme, and the disaster with which it was attended:—After the *diving-bell* was invented, it was considered desirable to devise some means of remaining for any length of time under water, and rising at pleasure without assistance. "Some years ago, an ingenious individual proposed a project, by which this end was to be accomplished. It consisted in sinking the hull of a ship made quite water-tight, with the decks and sides strongly supported by shores, and the only entry secured by a stout trap-door, in such a manner, that, by disengaging from within the weights employed to sink it, it might rise of itself to the surface. To render the trial more satisfactory and the result more striking, the projector himself made the first essay. It was agreed that he should sink in twenty fathoms water, and rise again without assistance at the expiration of twenty-four hours. Accordingly, making all secure, fastening down his trap-door, and provided with all necessaries, as well as with the means of making signals to indicate his situation, this unhappy victim of his own ingenuity entered, and was sunk. No signal was made, and the time appointed elapsed. An immense concourse of people had assembled to witness his rising, but in vain: for the vessel was never seen more. *The pressure of the water at so great a depth* had, no doubt, been completely underestimated, and the sides of the vessel being at once crushed in, the unfortunate projector perished before he could even make the signal concerted to indicate his distress."*

Many other applications of the principles of hydrostatics might have been mentioned, but what has been now stated may serve to exemplify the practical utility of an acquaintance with such principles, not only to engineers and superintendents of public works, but to mechanics and artificers of every description.

The science of *Pneumatics*, which treats of the mechanical properties of the atmosphere, will likewise be found useful to mechanics and artists of various descriptions, to whom it is, in many cases, of importance to know something of the effects of the *resistance*, the *pressure*, and the *elasticity* of air. The construction of barometers, syphons, syringes, and air-pumps depends upon the pressure of the atmosphere, and likewise water-pumps, fire-engines, and many other hydraulic machines; and, consequently, the constructors of such instruments and engines must frequently act at random, if they are unacquainted with the nature and properties of the atmosphere, and the agency it exerts in such mechanical contrivances.† Even the carpenter and the *mason* may be directed, in some of their operations, by an acquaintance with the doctrines of pneumatics. When two pieces of wood are to be glued together, they are first made as even and smooth as possible; the glue is then applied to one or both of the surfaces; they are then pressed together till the glue has become thoroughly dry. The use of the glue is to fill up every crevice in the pores of the wood, so as to prevent the admission of any portion of air between the pieces; and then the atmosphere, with a force equal to 15 pounds on every square inch, presses the pieces firmly together. A knowledge of this principle will suggest the propriety of filling up every opening or crevice, and continuing the pressure for some time, as the air, wherever it gains admission, has a tendency, by its elastic force, to loosen every species of cement. The same principle might direct bricklayers and masons, in building either stone or brick-walls, in suggesting the propriety of filling up every crevice with the most tenacious cements, so as to prevent the access of the external air to the interior of the walls. For there can be no question that the firmness and stability of our houses and garden-walls depend, in part, upon the pressure of the atmosphere, after the interior crevices are thoroughly filled up. An extensive knowledge of this science would likewise direct them to the

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* Herschel's "*Discourse on the Study of Nat. Philosophy.*"

† As an illustration of the importance of being acquainted with the atmospheric pressure, the following anecdote may be here inserted:—A respectable gentleman of landed property, in one of the middle counties of Scotland, applied to a friend of mine, a lecturer on Chymistry and Natural Philosophy, in order to obtain his advice respecting a pump-well which he had lately constructed at considerable expense. He told him, that,

notwithstanding every exertion, he could not obtain a drop of water from the spout, although he was quite sure there was plenty of water in the well, and *although he had plastered it all around, and blocked up every crevice.* When my friend inspected the pump, he suspected that the upper part of the well was air-tight, and, consequently, that the atmospheric pressure could not act on the surface of the water in the well. He immediately ordered a hole to be bored adjacent to the pump, when the air rushed in with considerable force; and, on pumping, the water flowed copiously from the spout. The gentleman was both overjoyed and astonished; but it is somewhat astonishing that neither he, nor his neighbours, nor any of the workmen who had been employed in its construction, should have been able to point out the cause of the defect; but, on the other hand, should have taken the *very opposite* means for remedying it, namely, by plastering up every crevice, so as to produce a kind of vacuum within the well. This and similar facts show how little progress scientific knowledge has yet made, even among the middle classes of the community.

proper mode of constructing the flues of chimneys, so as to prevent that most disagreeable of all circumstances in dwelling-houses, *smoky chimneys*. From ignorance of the effects of heat, of the experiments that have been made on rarefied air, and their relation to our common fires,—of the proper dimensions of funnels,—of the effects of winds and currents of air,—of the proper height and width of chimneys,—of the method of promoting a good draught, and making the air pass as near the fire as possible, and various other particulars requisite to be attended to in the construction of fireplaces and their flues; many dwelling-houses have been bungled, and rendered almost uninhabitable. The workmen, in such operations, without any rational principle to guide them, carry up funnels in the easiest way they can, according to the practice of "use and wont," and leave the tenants or proprietors of the houses they erect to get rid of their smoke in the best way their fancy can contrive. Whereas, were chimneys and their flues constructed according to the principles of science, they might be rendered, almost with certainty, completely efficient for the purpose intended.

To all who are acquainted with the nature and properties of elastic fluids, it must be obvious, that the whole mystery of curing smoky chimneys consists in finding out and removing the accidental causes which prevent the heated smoke from being forced up the chimney by the pressure of the cool or heavier air of the room. These causes are various; but that which will be found most commonly to operate is, the bad construction of the chimney *in the neighbourhood of the fireplace*. "The great fault," says Count Rumford, "of all the open fireplaces now in common use is, that they are much too large, or rather it is *the throat of the chimney*, or the lower part of its open canal, in the neighbourhood of the mantle, and immediately over the fire, which is too large." The following is a condensed view of some of the rules given on this subject, by this ingenious practical philosopher, and which are founded on the principles of science, and on numerous experiments:—1. The *throat* of the chimney should be perpendicularly over *the fire*; as the smoke and hot vapour which rise from a fire naturally tend *upwards*. By the *throat* of a chimney is meant the lower extremity of its canal, where it unites with the upper part of its open fireplace. 2. The nearer the throat of a chimney is to the fire the stronger will be its *draught*, and the less danger of its smoking; since smoke rises in consequence of its rarefaction by heat, and the heat is greater nearer the fire than at a greater distance from it. But the draught of a chimney may be too strong, so as to consume the fuel too rapidly; and, therefore, a due medium must be fixed upon, according to circumstances. 3. That *four inches* is the proper width to be given to the throat of a chimney, reckoning across from the top of the breast of the chimney, or the inside of the mantle to the back of the chimney; and even in large halls, where great fires are kept up, this width should never be increased beyond 4½ or 5 inches. 4. The width given to the back of the chimney should be about *one-third* of the width of the opening of the fireplace in front. In a room of a middling size, *thirteen inches* is a good size for the width of the back, and 3 times 13 or 39 inches for the width of the opening of the fireplace in front. 5. The angle made by the back of the fireplace and the sides of it, or covings should be 135 degrees, which

Fig. 1.

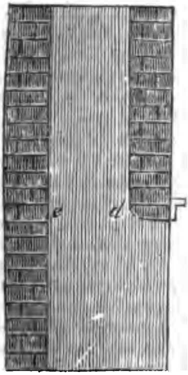
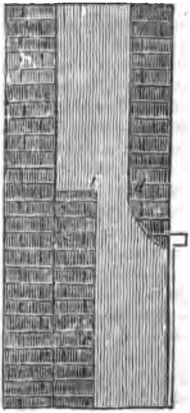


Fig. 2.



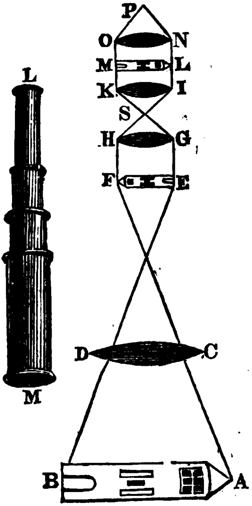
is the best position they can have for throwing heat into the room. 6. The back of the chimney should always be built *perfectly upright.* 7. Where the throat of the chimney has an end, that is to say, where it enters into the lower part of the open canal of the chimney, *there* the three walls which form the two covings and the back of the fireplace should *all end abruptly*, without any slope, which will render it more difficult for any wind from above to force its way through the narrow passage of the throat of the chimney. The back and covings should rise 5 or 6 inches higher than the breast of the chimney. 8. The current of air which, passing under the mantle, gets into the chimney, should be made *gradually to bend its course upwards;* by which means it will unite *quietly* with the ascending current of smoke. This is effected with the greatest ease and certainty, merely by *rounding off* the breast of the chimney, or back part of the mantle, instead of leaving it flat or full of holes and corners. *Fig.* 1 shows the section of a chimney on the common construction, in which *d e* is the throat. *Fig.* 2 shows a section of the same chimney altered and improved, in which *d i* is the reduced throat, four inches in the direction of *d i*, and thirteen inches in a line parallel to the mantle.

Masons, bricklayers, and others, who are interested in this subject, would do well to procure and study Count Rumford's "Essay," which was originally sold for two shillings. His directions have seldom been accurately attended to in this country by those who have pretended to improve chimneys on the principles he has laid down, partly from carelessness, and partly from ignorance of the elements of science. When the grate is not set in its proper place, when its *sloping* iron back is retained,—when no pains have been taken to make its ends coincide with the covings of the fireplace,—when the mantle, instead of having its back rounded off, is a vertical plane of iron, cutting a column of smoke which rises beneath it; and, above all, when the throat of the chimney, instead of *four*, is made, as we often see, *fourteen* inches wide,—not one of the count's directions has been attended to, and his principles have as little to do with the construction of such a chimney, as with the building of the dikes of Holland, or the Pyramids of Egypt.

A knowledge of the science of *Optics*, which explains the nature of vision, and the laws by which light is refracted and reflected, is essentially requisite to the makers of *telescopes*, *microscopes*, and all other dioptric and catoptric instruments, in order to carry them forward to their highest pitch of improvement. And yet how often do we find many of those employed in the construction and manufacture of such instruments glaringly deficient in the first principles of optical science. One maker imitates the instruments of another without discrimination, and while he sometimes imitates the excellences, he as frequently copies the defects. Hence the glaring deficiencies in the construction of the eye-pieces of most of our pocket-telescopes, and the narrow field of view by which they are distinguished, which a slight acquaintance with the properties of lenses would teach them to obviate. By a moderate acquaintance with the principles of this science, any ingenious mechanic might, at a small expense, be enabled to construct for himself many of those optical instruments by which the beauties of the animal and vegetable kingdoms, and the wonders of distant worlds, have been explored.

Although, in the hands of mathematicians, the science of optics has assumed somewhat of a forbidding appearance to the untutored mind, by the apparently complex and intricate diagrams by which its doctrines have been illustrated, yet it requires only the knowledge of a few simple facts and principles to guide an intelligent mechanic in his experiments, and in the construction of its instruments. In order to the construction of a refracting telescope, it is only requisite to know, that the rays of light passing through a convex-glass paint an image of any object directly before it, at a certain point behind it, called its *focus;* and that this image may be viewed and magnified by another convex-glass, placed at a certain distance behind it. Thus, let CD, *Fig.* 1, represent a convex glass, whose focal distance CE is 12 inches; let AB represent a distant object directly opposite; the rays of light passing from this object, and crossing each other, will form an image of the object AB, at EF, in an *inverted* position. Let GH represent another convex glass, whose focal distance is only one inch. If this glass is placed at one inch distant from the image EF, or 13 inches from the glass CD, and the eye applied at the point S, the object AB will be seen turned upside down, and magnified in the pro-

Fig. 1.



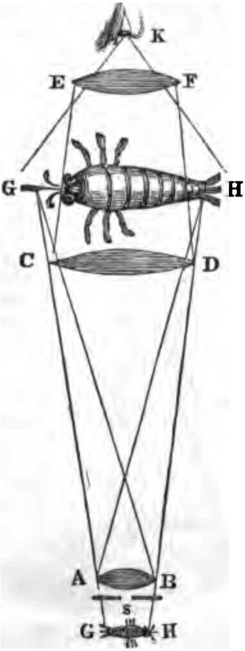
portion of 1 to 12, or twelve times in length and breadth. This forms what is called an *Astronomical* telescope; but, as every thing seen through it appears inverted, it is not adapted for viewing terrestrial objects. In order to fit it for viewing land objects, two other eye-glasses, of the same focal distance (namely, one inch), are requisite; the second eye-glass IK is placed at 2 inches from GH, or double their focal distance, and the glass NO at the same distance from IK.* By this means a second image IM is formed in an *upright* position, which is viewed by the eye at P, through the glass NO, and the object appears magnified in the same

* This is not the best form of a terrestrial eye-piece; but it may serve for the purpose of illustration. The eye-piece now most generally used consists of *four* lenses, combined on a different principle.

proportion as before. The magnifying power of a telescope of this construction is found by dividing the focal distance of the object-glass by the focal distance of the eye-glass. Thus, if the object-glass be 36 inches in focal distance, and the eye-glass 1½ inches, the magnifying power will be 24 times; if the focus of the eye-glass be 2 inches, the magnifying power will be 18 times, &c.—LM is the telescope fitted up for use.

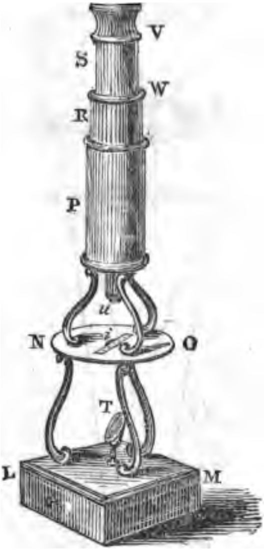
A compound microscope might likewise be easily con-

Fig. 2.



structed by any ingenious artisan or mechanic, by attending to the following illustrations and directions. *Fig.* 2 represents the glasses of a compound microscope. AB is the glass next the object; CD is the amplifying glass for enlarging the field of view; EF is the glass next the eye. When a small object, as GH, is placed below the object-glass AB, at a little more than its focal distance from it, a magnified image of this object is formed by the glass AB at GH, which is magnified in proportion as the distance GG exceeds the distance of AG. This magnified image of the object is magnified a second time by the glass EF, to which the eye is applied at K. This instrument, when fitted up

Fig. 3.

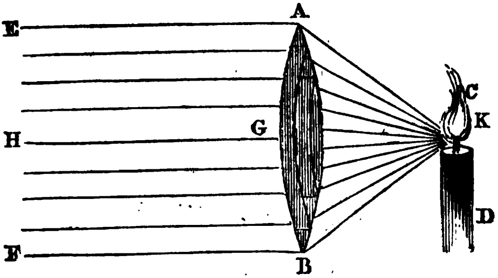


for use, is represented in *Fig.* 3, where LM represents a box or pedestal on which it stands, NO the stage on which the objects are placed, over the opening *i*, which is supported by three pillars fixed to the top of the box. P is a tube which is supported by three pillars fixed in the stage. In this tube the tube R slides up and down for adjusting the focus. The small tube *u*, which carries the object-glass, is connected with the tube R, and slides up and down along with it. S is the tube which contains the two eye-glasses, and which may be made to slide up and down into the tube R, for increasing the magnifying power when occasion requires. T is a mirror, fixed on the pedestal, capable of moving up and down, and to the right or left, for throwing light upon the object placed over the hole *i*, which may be laid upon a slip of thin glass. The object-glass AB, *Fig.* 2, is placed at *u*, *Fig.* 3. The glass CD is placed opposite W, *Fig.* 3, and the eye-glass EF opposite V.

Such are the essential parts of a compound microscope. Any common mechanic may construct one for himself by attending to the following directions:—The object-glass AB, *Fig.* 2, may be about ½, ¾, or 1 inch focal distance, and the aperture, or hole which lets in the light from the object, should not exceed 1-10th of an inch, otherwise it will cause a glare, which will produce an indistinct image of the object. The amplifying glass CD may be 2½ inches focal distance, and 1½ inches in diameter. This glass is not *essentially* necessary, but it serves to enlarge the field of view, and to render it more distinct near the border. The eye-glass EF should be about 1 inch focus, and about ¾ inch in diameter. With respect to the *distances* at which they should be placed from each other, the glass CD may be placed at about 5 or 6 inches from AB, and the glass EF about 2 inches, or 1¾ inches from CD. The object-glass should be a *double* convex—the eye-glasses may be *plano-convex*; that is, plane on the one side and convex on the other, with the plane sides turned next the eye; but double convexes will do, if these cannot be procured. The tubes which contain the glasses may be made of paste-board, and the stage, pillars, and box, of wood. The glasses may be procured for about 4 shillings; and if the individual fit them into the tubes, and perform all the other operations requisite, the expense of all the other materials will not exceed other four shillings. Suppose, now, that the object-glass AB is ½ inch focal distance, and the image GH is formed at the distance of 6 inches from it, this image will be larger than the object, nearly in the proportion of 6 to ½, or 12 times. Suppose the glass EF, considered in connexion with CD, to possess a magnifying power equal to 5 times; then the whole magnifying power will be 5×12, or 60 times. The object, therefore, will be magnified 60 times in length and in breadth, and, consequently, the surface will be magnified 3600 times, which is the square of 60. With such a microscope, the animalculæ in water, the circulation of the blood in frogs and fishes, the small feathers which compose the dust on butterflies' wings, and all the most interesting appearances of the minute parts of animals and vegetables, may be distinctly perceived.

Besides the discoveries in the heavens and in the minute parts of creation to which the study of the science of optics has led, its principles are capable of being directed to many important purposes in human life and society. By means of large burning mirrors and lenses the rays of the sun have been condensed, so as to increase their intensity more than seventeen thousand times, and to produce a heat more than four hundred times greater than that of our common fires, which would serve for the combustion and fusion of numerous substances, which are infusible in the greatest heat that can be produced in our common furnaces. The property of a convex lens, by which rays proceeding from its focus are refracted into parallel directions, has enabled us to throw, from lighthouses, *a strong light* to great distances at sea. The large polyzonal, or *built up* lenses, contrived by Sir D. Brewster, which may be made of any magnitude, and the elegant lamp of Lieutenant Drummond,—the one producing the most intense light yet known, and the other conveying it undispersed to great distances,—promise to introduce improvements hitherto unthought of, and to diversify the nocturnal scenery both of sea and land. For, in the progress of extensive national improvements, they might be made subservient, in connexion with carburetted hydrogen gas, in enlivening and decorating the rural scene in the absence of the sun, and in guiding the benighted traveller in all his journeyings. For, when we consider the improvements, in almost every department of the social state, which have been lately carried forward, it is surely not too much to expect that, in the course of a century hence, our highways, villages, hamlets, and even some of our moors and mountains, shall be lighted up with gas lamps, connected with mirrors and lenses, analogous to those which illuminate our cities and towns, and which direct the mariner, when approaching our shores. The following figure shows the manner in which a large lens throws a light to great distances. Let AB, *Fig*. 4, represent one of Sir D. Brewster's

Fig. 4.



polyzonal lenses, or any other large lens, and GK its focal distance; if a luminous body CK, as the flame of a lamp, be placed at the focal point K, the rays of light, diverging from CK, after passing through the lens AB, will proceed in a *parallel direction*, AE, GH, BF, and may illuminate objects at very considerable distances. AB, *Fig*. 4, represents a section of the polyzonal lens built of ten different pieces. L, *Fig*. 5, exhibits a *front* view of the same lens. Could such lenses be constructed of the size of 6, 8, 10, or 12 feet diameter, they would produce a degree of heat from the solar rays far surpassing what has hitherto been effected, and be capable of throwing a brilliant light to immense distances.

Fig. 6 shows the manner in which a *concave mirror* TU reflects the light of a lamp VW, placed in its focus, to great distances. It is in this way that the light of the Bell Rock, and other lighthouses, is reflected to more than thirty or forty miles distant.

Even the sciences of *electricity* and *galvanism* might, in some instances, be rendered subservient to the operations

Fig. 5.

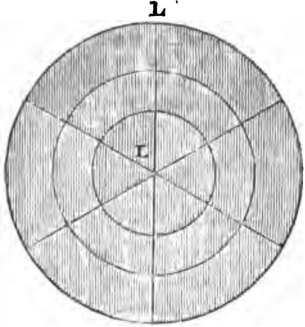
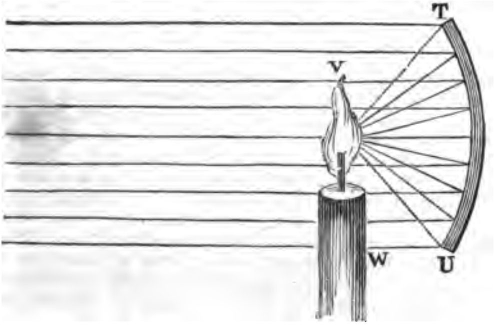
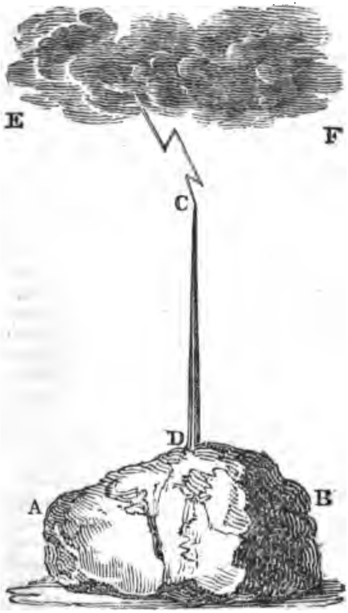


Fig. 6.



of art. By means of the electrical fluid, models of corn-mills, water-pumps, and orreries, showing the diurnal motion of the earth, and the age and phases of the moon, have been set in motion; and there can be no question, that, in the hands of genius, it might be directed to accomplish much more important effects. Even the lightning of the clouds, which is only the electrical fluid acting on an ample scale, has been guided by the hand of art to perform mechanical operations, by splitting large stones into shivers. This has been effected in the following manner: Suppose AB to represent a stone or portion of a rock, which is intended to be split into a number of pieces. Into the midst of this stone a long rod of iron, or conductor, CD, is inserted, which terminates in a point. When a thunder-cloud, as EF, passes over the stone, within its striking distance of the earth, the lightning from the cloud strikes the upper part of the pointed conductor, and is conducted downwards to the heart of the stone, which either rends it in different places, or



splits it at once into a multitude of fragments. This experiment, which appears to have been first made in Prussia, in 1811, was attended with complete success, during the first storm that passed over after the bar of iron was inserted in the stone.

To brasiers, tinsmiths, coppersmiths, and other workers in metals, a knowledge of *galvanism* might suggest a variety of useful hints, especially where it is an object of importance to secure any piece of metallic workmanship from *rust*. It is found that when metals are pure and kept separate from each other, they remain for a long time untarnished; but when alloyed, or placed in contact with other metals, they soon undergo oxidation. Coins composed of one metal are found more durable than those composed of two; and the copper sheathing of ships which is fastened with iron nails soon undergoes corrosion. These effects are now explained on the principles of galvanism. When two metallic substances of different kinds are connected by moisture, they form what is called a *galvanic circle;* and, therefore, when one kind of metal is placed in contact with another, if either water or the moisture of the atmosphere adheres to them, a galvanic circle is formed, and oxidation is produced. On this ground the late Sir Humphrey Davy suggested the propriety of fastening the upper sheathing of ships with *copper* instead of *iron* nails. The same principle may be rendered of extensive application, and may afford many useful hints to every artisan employed in working and combining metals.

A knowledge of *magnetism* might also, in many cases, be directed to useful practical applications. This mysterious power, in connexion with its polarity, has already enabled the miner and surveyor to traverse the remotest corners of the largest mines, and to trace their way back in safety through all the windings of those subterraneous apartments, and has directed the navigator to steer his course with certainty, through the pathless ocean, to his "desired haven." Throughout all the regions of the globe the magnetic power extends its influence; and it is now found to have an intimate connexion with heat, electricity, and galvanism. Of late years, it has been ascertained that iron, its oxides, and alloys are not the only substances susceptible of magnetic influence. The magnetism of *nickel*, though inferior to that of iron, is found to be considerable; and that of *cobalt* and *titanium* is quite perceptible. Nay, the recent discoveries of *Arago* have shown, "that there is no substance but which, under proper circumstances, is capable of exhibiting unequivocal signs of the magnetic virtue." In consequence of a recent discovery of *M. Oersted*, "we are now enabled to communicate, at and during pleasure, to a coiled wire, *of any metal indifferently*, all the properties of a magnet—its attraction, repulsion, and polarity, and *that* even in a more intense degree than was previously thought to be possible in the best natural magnets." This discovery tends to enlarge our views of the range of magnetic influence, and to lead us to the conclusion that its powers may hereafter be applied to purposes of which at present we can have no conception. Although the polarity of the magnet has been of incalculable service to mankind, particularly in promoting navigation and enlarging our knowledge of the globe, yet we have no reason to believe that this is the only practical purpose to which its powers may be applied, or the only reason why the Creator has so widely diffused its influence in the system of nature; since, in his diversified operations in the material world, he so frequently produces a variety of effects from one and the same cause. It remains with man to prosecute his observations still more extensively on this subject, and his industry will, doubtless, be rewarded with the discovery of new relations, laws, and combinations, which may be susceptible of the most important practical applications in the arts which minister to the comfort and convenience of mankind. Even in its present state, the attractive property of magnetism is capable of being applied as a *mechanical* power, in certain pieces of machinery, although its application in this way has never yet been attempted on an extensive scale.

The following fact shows how its attractive power has lately been applied for the prolongation of life, and the warding off of incurable disease, in the case of a useful class of our fellow-men. "In needle manufactories the workmen who point the needles are constantly exposed to excessively minute particles of steel which fly from the grindstones, and mix, though imperceptible to the eye, as the finest dust in the air, and are inhaled with their breath. The effect, though imperceptible on a short exposure, yet being constantly repeated from day to day, produces a constitutional irritation, dependent on the tonic properties of the steel, which is sure to terminate in pulmonary consumption; insomuch, that persons employed in this kind of work used scarcely ever to attain the age of forty years. In vain was it attempted to purify the air, before its entry into the lungs, by gauzes or linen guards; the dust was too fine and penetrating to be obstructed by such coarse expedients, till some ingenious person bethought him of that wonderful power which every child that searches for its mother's needle with a magnet, sees in exercise. Masks of magnetized steel wire are now constructed and adapted to the faces of the workmen. By these the air is not merely *strained* but *searched* in its passage through them, and each obnoxious atom arrested and removed."*

This interesting fact affords a striking proof of the useful purposes to which the powers and properties of natural substances may be applied, when the mind is directed to contemplate them in all their bearings, and to trace them to all their legitimate consequences. The attractive power of the magnet, considered not only in its relation to iron and steel, but to all other substances in which magnetical virtue is found in a greater or less degree to reside, might, therefore, in the hands of an ingenious mechanic, lead to many interesting experiments which might pave the way for the most important practical results.

The facts connected with the science of *geology* may likewise, in many instances, be directed to practical purposes. From the researches which, of late years, have been made in the interior of the earth, geologists are now pretty well acquainted with the position and alternation of its strata, and with the different fossils which may be expected to abound in any particular district. Although these researches were undertaken chiefly with a view to ascertain the changes which have happened in the structure of our globe, and to support certain theories of the earth, yet they may frequently be of use to landed proprietors, to engineers, and to speculators in *mining* operations, so as to direct them in their investigations, and prevent them from embarking in schemes that may ultimately blast their expectations, exhaust their resources, and lead to irretrievable ruin. The ruinous effects sometimes produced by ignorance of this subject are strikingly illustrated by the following fact:—

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* Herschel's *Prelim. Dis. on Nat. Philos.*

"It is not many years since an attempt was made to establish a colliery at Bexhill, in Sussex. The appearance of thin seams and sheets of fossil wood and wood-coal, with some other indications similar to what occur in the neighbourhood of the great coal-beds in the north of England, having led to the sinking of a shaft, and the erection of machinery on a scale of vast extent, not less than eight thousand pounds are said to have been laid out on this project; which, it is almost needless to add, proved completely abortive, as every geologist would have at once declared it must, the whole assemblage of geological facts being adverse to the existence of a regular coal-bed *in* the Hastings' *sand;* while this on which Bexhill is situated is separated from the *coal strata* by a series of interposed beds of such enormous thickness as to render all idea of penetrating *through* them absurd. The history of mining speculations is full of similar cases, where a very moderate acquaintance with the *usual order of nature*, to say nothing of theoretical views, would have saved many a sanguine adventurer from utter ruin."*

The study of the various branches of *Natural History* might also be rendered productive of utility in different departments of the arts. It is quite evident that a scientific knowledge of *Botany* must be highly useful to gardeners and their labourers, and to all who take an interest in horticultural and rural operations. Not only a knowledge of the *classification* and arrangement of plants, but also of their physiological structure and functions, of their medicinal qualities, and of the chymical properties of soils and the different manures, will be found of considerable utility to such individuals. *Zoology* and *Comparative Anatomy*, which describe the peculiar structure and habits of animals, both foreign and domestic, will convey various portions of interesting information to shepherds, cattle-dealers, and agriculturists of every description. An acquaintance with *Mineralogy*, which treats of the solid and inanimate materials of our globe,—the earthy, saline, inflammable, and metallic substances of which it is composed, must be interesting to lapidaries, jewellers, iron-founders, and all who are employed in working various metals. To know the nature of those substances on which they are operating, the materials with which they are united in their native ores, their combination with phosphorus, sulphur, and carbon, the changes produced upon them by oxygen and the different acids, their relations to heat, and the liquids with which they may come in contact, and the various compounds into which they may be formed, will have a direct tendency, not only to increase their stock of general knowledge, but to render them more skilful and intelligent in their respective professions. *Meteorology*, which treats of the weather and the variable phenomena of the atmosphere, will, in many instances, be found a useful study to mariners, fishermen, travellers, and farmers, by which they may frequently be directed in their movements, and avoid many inconveniences and dangers. By carefully attending to the motions of the barometer and thermometer, and comparing them with the electrical state of the atmosphere, the direction of the winds, and the appearances of the clouds, the farmer may be warned of the continuance of rain or drought, and direct his operations accordingly, so as to protect his produce from danger.

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* Herschel's *Discourse*, &c.

There is no application of science to the arts of more importance, and more extensive in its effects, than that of the employment of *steam* for driving all kinds of machinery, and for propelling vessels along rivers and across the ocean. "It has armed," says Mr. Jeffrey, "the feeble hand of man with a power to which no limits can be assigned—completed the dominion of mind over the most refractory qualities of matter, and laid a sure foundation for all those future miracles of mechanic power which are to aid and reward the labours of after generations." The first person who appears to have entertained the idea of employing steam for propelling vessels was Mr. J. Hulls, in the year 1736. But it was not till 1807, when Mr. Fulton launched, at New-York, the first steamboat he had constructed, that navigation by steam was introduced to general practice, which may therefore be considered as the epoch of the invention. In a few years every river and bay in the United States became the scene of steam navigation. In 1822 there were more than 350 steam-vessels connected with these States, some of them of eight and nine hundred tons burden, and by this time, doubtless, they are more than doubled. In 1819 an expedition left Pittsburg, descended the Ohio in steamboats for 1100 miles, and then, ascending the rapid Missouri, proceeded to the distance of no less than two thousand five hundred miles. They have now been introduced into every country in Europe. On the principal rivers and seas connected with the British isles, and even in the Scottish lakes, these vessels are sweeping along in majestic pomp, against wind and tide, diversifying the scenery through which they pass, and transporting travellers and parties of pleasure to their destination, with a rapidity unexampled in former ages. On the Clyde alone more than fifty or sixty steam-vessels are constantly plying. The scenery of the Rhine, the Rhone, the Elbe, the Seine, the Danube, the Wolga, the lakes of Constance and Geneva, and of many other rivers and inland seas, is now enlivened by these powerful machines, conveying goods and passengers in every direction. Even the Atlantic Ocean, an extent of more than three thousand miles, has been traversed by a steamboat in twenty days; and the period, we trust, is not far distant, when the Red Sea, the Persian Gulf, the Bay of Bengal, the Indian Ocean, the Mediterranean, the Euxine, the Gulf of Mexico, and even the wide Pacific, will be traversed by these rapid vehicles, conveying riches, liberty, religion, and intelligence to the islands of the ocean, and forming a bond of union among all nations.

The admirable improvements in the construction of *steam-carriages* which are now going forward are no less worthy of attention. The rapid movements of these machines, which have been lately introduced on the Liverpool and Manchester railway, and the security and comfort with which they are attended, have excited the astonishment of every beholder. And no wonder,—since goods and passengers are now conveyed between these cities with a velocity of nearly thirty miles an hour! so that it may be said, with the strictest propriety, that the steam-engine is the most brilliant present ever made by philosophy to mankind.

The discovery of *carburetted hydrogen gas*, and its application to the purpose of illuminating our dwelling-houses, streets, and manufactories, may also be considered in reference to the arts. Every city, and every town of a moderate size, is now enlivened with the splendid brilliancy produced from this invisible substance; pipes for its conveyance have been laid, of many hundred miles in extent, and diverging into numerous ramifications, and thousands of artists are employed in conducting its manufacture, and forming tubes and other devices for distributing it in all directions.

Now, since the inventions to which I am adverting are founded on chymical and mechanical principles, and on the discoveries of modern science, and since many thousands of mechanics are now employed in constructing the machinery connected with these inventions, and in conducting its operations both by sea and land, it is of the utmost importance, in order to their being fully qualified for their respective departments, that they understand the scientific principles which enter into the construction of such machines and engines, the peculiar uses of every part, the manner in which the chymical agents employed operate, and the effects which, in any given circumstance, they must necessarily produce. In particular, it is indispensably necessary, that *engine-men*, and others employed for directing these machines when in operation, should be acquainted with every part of their structure, and the principles on which their movements depend; for the comfort and *safety* of the public are dependent on the caution and skill with which they are conducted. How could any man be qualified for such an office without some portion of scientific knowledge? and how could travellers in such vehicles consider their lives and property secure, if they were not guided by men of intelligence and prudence? To the want of such caution and skill are chiefly to be attributed most of the disasters and fatal accidents, connected with such operations, which have hitherto taken place.

Besides the agriculturists, manufacturers, mechanics, and artificers alluded to above, there are numerous other classes to which similar remarks will apply. In short, there is scarcely an individual, however obscure, in any department of society, but may derive practical benefit from an acquaintance with science. "The farm servant or day labourer," says Lord Brougham, "whether in his master's employ or tending the concerns of his own cottage, must derive great practical benefit,—must be both a better servant, and a more thrifty and, therefore, comfortable cottager, for knowing something of the nature of soils and manures, which chymistry teaches, and something of the habits of animals, and the qualities and growth of plants, which he learns from natural history and chymistry together. In truth, though a man is neither a mechanic nor a peasant, but only one having a pot to boil, he is sure to learn from science lessons which will enable him to cook his morsel better, save his fuel, and both vary his dish and improve it. The art of good and cheap cookery is intimately connected with the principles of chymical philosophy, and has received much, and will yet receive more, improvement from their application." Nay, even the *kitchen maid*, the laundry maid, and the mistress of every family, may derive many useful hints from the researches of science. The whole art of cookery is a chymical operation, and so are the arts of washing, dressing, bleaching, and dying. By a knowledge of the nature and properties of the acids and other chymical substances, they would learn how to eradicate stains of ink, grease, &c. from cotton, linen, woollen, and silks, in the safest and most effectual manner, and many other processes of great utility in domestic life. Even the art of kindling a fire, and of *stirring* it when kindled, depends on philosophical principles. For example, the stirring of a fire is of use, because it makes a hollow, where the air being rarefied by the adjacent heat, the surrounding air rushes into the partial vacuum, and imparting its oxygen, gives life to the fire, and carries the flame along with it. On this principle the following rules are founded:—1. Never stir a fire when fresh coals are laid on, particularly when they are very small, because they immediately fall into the vacuum, and prevent the access of the oxygen of the atmosphere, which is the principle of combustion. 2. Always keep the bottom bar clear, because it is there chiefly that the air rushes in to nourish the fuel. 3. Never begin to stir at top, unless when the bottom is quite clear, and the top only wants breaking, otherwise the unkindled fuel may be pressed down in a body to the bottom, and the access of atmospheric air prevented.

Illustrations, of a similar kind, of the practical applications of science, might have been given to an almost indefinite extent; but the above specimens may suffice as corroborative of the general position—that scientific knowledge would render mechanics and manufacturers of all descriptions more skilful in the prosecution of their respective employments.

Some, however, may be disposed to insinuate, that it is quite enough for philosophers to ascertain principles, and to lay down rules founded upon them, for the direction of the mechanic or artisan; or, that it is only requisite that the directors and superintendents of chymical processes and mechanical operations should be acquainted with that portion of science which is necessary for their peculiar departments. But it is easy to perceive that a mechanic who works merely by rules, without knowing the foundation or *reasons* of them, is only like a child who repeats his catechism by rote, without attaching a single idea to the words he utters, or like a horse driving a thrashing-machine, without deviating from the narrow circle to which he is necessarily confined. When any accident occurs, when the circumstances of the case are somewhat changed, when the same principle on which he generally proceeds requires to be applied to a new object or mode of operation, he either blunders his work or feels himself utterly at a loss how to proceed. The least deviation from his accustomed trammels puts him out, because he has no clear and comprehensive view of the principles on which his practice depends. Hence we uniformly find that a man of scientific acquirements will easily comprehend the plan of any new machine or architectural operation, and be able to execute it, while he who works only by square and rule will hesitate at every step, and perceive innumerable difficulties in his way. To confine artists to mere rules, without a knowledge of the principles on which they are founded, is to degrade their intellectual nature, to reduce them to something like mere machines, to render them less useful both to themselves and to their employers, and to prevent the improvement of the liberal and mechanical arts.

The following instance may be stated as a specimen of the advantages of chymical knowledge, and of the practical purposes to which it may be applied in different regions of the globe.—A young Parisian of the name of Leger went on a commercial adventure to Egypt in the year 1822; but during some of the convulsions of that unsettled country, he lost the little property with which he was intrusted, and was forced to make a precipitate retreat from Suez to Alexandria. He remained some time at Alexandria, destitute and almost hopeless. But the talent of observation, and the social habits characteristic of his countrymen, came to his aid: in a lucky moment he formed the resolution of retrieving his fortune by introducing the luxury of *ice* into the parched land of the Ptolemys. This common product of wintry regions is known to be as grateful to the languid natives of tropical climates as ardent spirits are to the benumbed inhabitants of the Polar Circle. Having succeeded in effecting a return to his family, the enterprising Parisian was enabled by the friendly assistance of Gay Lussac and Thenard, to adopt the best means that chymistry could devise for the preservation of ice, both during the voyage, and after its arrival in a sultry latitude; and at length set out from Paris with his inventions, and arrived safely at Alexandria, in April, 1823. The sovereign of Egypt, Mohammed Ali, was delighted at this novel addition to oriental luxuries; and, besides valuable presents, gave the inventor the exclusive right for five years of importing ice into his dominions. This privilege is estimated to be worth one million of francs, or nearly 50,000*l.* In ancient times the world was enlightened by the learning of Egypt; the greatest philosophers travelled thither as to the fountain-head of science: but the land of Sesostris and Alexander has now become the prey of the ferocious Moslem; and whatever she enjoys of art, knowledge, or civilization she is compelled to receive from the once barbarous regions of the West.*

II. Scientific knowledge will not only render persons more skilful in their respective employments, but *will enable them to make improvements in the arts, and in the physical sciences with which they are connected.*

It has frequently been affirmed, that many useful inventions have been owing to *chance*, and that persons ignorant of science have stumbled upon them without any previous investigation. It is not denied that several inventions have originated in this way, but they are much fewer than is generally imagined; and, in almost every instance where chance suggested the first hint of any invention, the future improvements were directed by the hand of genius and the aids of science. It is said that the invention of the telescope was owing to a spectacle-maker's boy having accidentally taken up two convex glasses of different focal distances, and placed the one near his eye and the other at a considerable distance, when he perceived, on looking through them, the spire of a neighbouring church turned upside down, and much larger than its usual size. The father of the boy, amazed at this singular appearance, bethought himself of adjusting two glasses on a board, supporting them in two brass or wooden circles, which might be removed nearer to or farther from each other at pleasure, as in the following figure where A represents the object, B the lens next the

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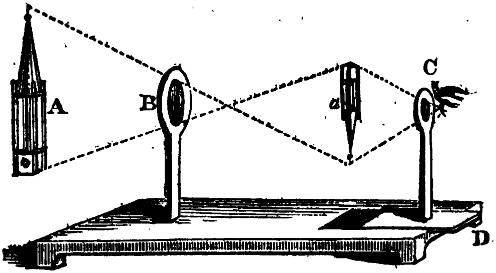
* Scots Mechan. Mag. 1825.

Fig. 24.



object, *a* the inverted image formed by it, C the glass next the eye, and D the sliding board on which it was fixed, for adjusting the focus. Such appears to have been the first rude construction of the telescope. But so long as the invention remained in this state it was of little benefit to society. It was not before Galileo, a philosopher of Tuscany, heard of the circumstance, and entered into investigations on the refraction of light and the properties of lenses, that this noble instrument was improved and directed to the heavens for the purpose of making astronomical discoveries; and all the subsequent improvements it has received have been the result of reasonings, and experimental investigations, conducted by men of science. Sir Isaac Newton, *in consequence of his experiments and discoveries respecting light and colours,* detected the true cause of the imperfection of the common refracting telescope, and suggested the substitution of metalline specula instead of lenses, which led him to the invention of the *reflecting* telescope; and Mr. Dollond, *in consequence of his investigations and experiments respecting the different degrees of refraction and divergency of colour produced by different kinds of glass*, effected the greatest improvement that had ever been made on the *refracting* telescope, by producing an image free of the imperfections caused by the blending of the prismatic colours. And we have reason to believe, that the further improvement of this telescope will chiefly depend on ascertaining the true chymical composition of flint-glass for achromatic purposes, and the proper mode of conducting its manufacture, which may lead to the construction of instruments of this kind on a more extensive scale than has ever yet been attempted, and to discoveries in the celestial regions far beyond those which have hitherto been made. But such improvements can never be effected, unless by numerous experimental investigations, conducted by those whose minds are thoroughly imbued with the principles of chymical and optical science.*

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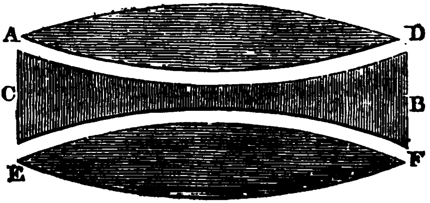
* One of the latest improvements on achromatic object-glasses was made by a foreigner of the name of *Guinand*, who was originally a cabinet-maker. After acquiring a knowledge of the principles of optics, and of the mode of constructing telescopes, he applied himself particularly to ascertain the proper composition of *flint-glass* for achromatic purposes; and, after spending twenty or thirty years in making experiments—casting one pot of glass after another, and meeting with frequent disappointments,—he at length succeeded in obtaining glass for achromatic telescopes, of larger dimensions and of a quality superior to what could formerly be procured. Of this glass was formed the largest triple achromatic telescope ever constructed, which was lately erected in the observatory of the university at Dorpat, under the direction of M. Fraunhofer. This glass is perfectly free from veins, and has a greater dispersive power than any obtained before. The diameter of this object-glass is almost ten inches, and its focal distance fifteen feet. It has four eye-pieces, the lowest magnifying 175 times, and the highest 700 times. Mr. Tulley of Islington lately constructed, of similar materials, manufactured by the same artist, a telescope whose object-glass is about seven inches diameter, and its focal length twelve feet, which is now in the possession of Dr. Pearson. The piece of

With regard to the invention and improvement of the *steam-engine*—a story has been told "that an idle boy being employed to stop and open a valve, saw that he could save

flint-glass of which the concave lens was formed cost Mr. Tulley about thirty guineas. Unfortunately for science, the ingenious artist (Guinand) is now dead, and it is uncertain whether he has left any particular details of his process behind him. The possibility, however, of procuring glass for the construction of very large achromatic telescopes is now put beyond a doubt.

The unscientific reader may acquire a *general* idea of an achromatic object-glass from the following figure,—where AD represents a double unequally convex lens of *crown-glass*, CB a double concave of *flint-glass*, and EF another convex lens of crown-glass. These are placed together in the manner represented in the figure, and form what is called an achromatic object-glass,—the term *achromatic* signifying *free of colour.* Sometimes only two lenses, a convex of crown, and a concave of flint-glass, are combined for the same purpose. In the case of a single convex glass, the image formed is blended with the prismatic colours, which come to foci at different distances from the lens, and consequently produce a comparatively indistinct image, which will not admit of a high magnifying power. But the achromatic lens, forming an image without colour, will bear a larger aperture, and a higher magnifying power, than a common refractor of the same length. So great is the difference—that an achromatic telescope of Dollond, only three feet ten inches in length, was found to equal, and even excel, the famous aerial telescope of Huygens of 123 feet focal length, and the gentlemen present at the trial agreed that "the dwarf was fairly a match for the giant." The principal obstacle to their construction on a large scale is, the difficulty of procuring large pieces of flint-glass free of veins, and of a proper dispersive quality.

Fig. 25.



himself the trouble of attending and watching it, by fixing a plug upon a part of the machine which came to the place at the proper times, in consequence of the general movement." Whether or not this story has any foundation in truth—certain it is, that all the most useful improvements in this engine have been the result of the most elaborate researches and investigations of scientific truths. The first distinct notion of the structure and operation of this powerful machine appears to have been given by the Marquis of Worcester, in 1663, in his "Century of Inventions." Its subsequent improvements by Savary, Blackey, Newcomen, Beighton, and Fitzgerald were the results of physical knowledge, of mechanical skill, and of the most laborious investigations. Its latest and most important improvements by Mr. James Watt were owing no less to the scientific knowledge which adorned his mind, than to his mechanical ingenuity. He was a man of a truly philosophical mind, eminently conversant in all branches of natural knowledge, and the pupil and intimate friend of Dr. Black, and had attended the lectures of that distinguished philosopher in the university of Glasgow. And he often acknowledged "that his first ideas on this subject were acquired by his attendance on Dr. Black's chymical lectures, and from the consideration of his theory of latent heat, and the expansibility of steam." We may therefore rest assured, that all the future improvements and new applications of this noble invention will be the result of physical and chymical knowledge combined with mechanical skill; and, consequently, no artisan can ever expect to be instrumental in bringing the steam-engine to its highest pitch of improvement, and in directing its energies to all the purposes to which they may be applied, unless the pursuits of science occupy a considerable share of his attention.

The first hint of the *Mariner's compass* is generally supposed to have been owing to chance. Some persons may have accidentally observed, that when a small loadstone is suspended in water on a piece of wood or cork, its ends pointed towards the south and north. Such experiments seem to have been applied at first for mere amusement, and to excite astonishment in the minds of the ignorant and illiterate. But it was not till some genius possessed of science and of reflecting powers seized the hint thus given, that it was applied to the important purpose of directing the mariner in his course through the pathless ocean. And to science we are indebted for the manner of determining the *declination* of the needle, in all parts of the world, by means of the azimuth compass, and thus rendering it an accurate guide to the navigator in every region through which he moves. The discovery of that peculiar principle termed *Galvanism* was partly owing to accident. While Galvani, professor of anatomy at Bologna, was one day employed in dissecting a frog, in a room where some of his friends were amusing themselves with electrical experiments, one of them having happened to draw a spark from the conductor, at the same time that the professor touched one of the nerves of the animal, its whole body was instantly shaken by a violent convulsion. Having afterward suspended some frogs from the iron palisades which surrounded his garden, by means of metallic hooks fixed in the spines of their backs, he observed that their muscles contracted frequently and involuntarily, as if from a shock of electricity. Such facts, presented to the view of unscientific persons, might have produced nothing more than a gaze of wonder; perhaps supernatural powers might have been resorted to in order to account for the phenomena, and in a short time they might have been forgotten as a vision of the night. But such scientific minds as those of Valli, Volta, Monro, Fowler, Davy, Humboldt, and Wollaston, having seized upon these facts, having contemplated them in every point of view, and instituted experiments of every description in relation to them—most astonishing discoveries in science have been brought to light—the whole aspect of chymistry has been changed, and numerous improvements introduced into the practice of the useful arts. Alkalis have been decomposed, new metallic substances discovered, the cause of the *corrosion* of metals ascertained, and the means determined by which it may be effectually prevented.

It is a truth which the whole history of science fully corroborates, that very few important discoveries have been made by accident or by ignorant persons, whose minds were not directed to the particular object of research. On the other hand, we have every reason to believe, that there are many facts and circumstances which have passed under the inspection of untutored minds, which, had they come within the range of men of science, would have led to many useful inventions which are yet hid in the womb of futurity, and which will reward the industry of more enlightened generations. The inventions to which we have now adverted, and many others, where chance suggested the first rude hints, would, in all probability, have lain for ages in obscurity, without any real utility to mankind, had not the genius of science seized upon them, viewed them in all their bearings, and traced them to all their legitimate consequences and results. Had the telescope, the steam-engine, and the mariner's compass, in their first embryo state, remained solely in the hands of ignorant empirics, they might have been reserved merely as playthings, for the purpose of vulgar amusement, or exhibited by cunning impostors to aid their deceptions, or to produce a belief of their supernatural powers. But science snatched them from the hands of the ignorant and the designing, and having added the requisite improvements, bequeathed them to mankind as the means of future advancement in the paths of knowledge, and in the practice of the arts.

It may be laid down as a kind of axiom, to which few exceptions will occur, that great discoveries in science and improvements in art are never to be expected but as the result of knowledge combined with unwearied investigation. This axiom might be illustrated, were it necessary, from what we know of the past history of our most useful inventions. The celebrated M. Huygens—who first discovered the means of rendering clocks exact by applying the *pendulum*, and rendering all its vibrations equal by the cycloid—was one of the first mathematicians and astronomers of his age. He had long kept the object of his pursuit before his mind, he plied his mechanical ingenuity in adapting the machinery of a clock to the maintaining of the vibrations of a pendulum, and by his mathematical knowledge investigated the theory of its motion. By the aid of a new department of geometrical science, invented by himself, he showed how to make a pendulum swing in a cycloid, and that its vibrations in this curve are all performed in equal times, whatever be their extent. The ingenious Mr. Robert Hooke who was the inventor of spring or pocket watches, and of several astronomical instruments for making observations both at sea and land—was eminently distinguished for his philosophical and mathematical acquirements. From his earliest years he discovered a genius for mechanics, and all his other knowledge was brought to bear upon his numerous inventions and contrivances. Otto Guerieke, who *invented* the *air-pump*, was one of the first mathematicians of his time; and the honourable Robert Boyle, who *improved* this valuable instrument, was one of the most illustrious philosophers of the age and country in which he lived. Mr. Ferguson, the inventor of several orreries, the astronomical rotula, the eclipsarian, the mechanical paradox, and other astronomical machinery, had, from his earliest years, devoted the greatest part of his time to the study of mechanics, and the physical and mathematical sciences with which it is connected, as appears from the numerous popular works which he published on these subjects which are still in extensive circulation. The late Mr. Arkwright, the inventor of the *spinning jenny*, devoted many years to the study of mechanics and to the improvement of his invention, till he was perfectly conversant in every thing that relates to the construction of machinery. This admirable invention, by which a pound of the finest cotton has been spun by machinery into a yarn extending more than 119 miles, was not the result of chance, but of the most unwearied study and attention in regard to every circumstance which had a bearing on the object of his pursuit: and as he had not originally received any thing like a *regular* scientific education, his acquirements were the result of his own application and industry. "The new process of refining sugar, by which more money has been made in a shorter time, and with less risk and trouble, than was ever perhaps gained from an invention, was discovered by an accomplished chymist, E. Howard, brother of the Duke of Norfolk, and was the fruit of a long course of experiments, in the progress of which known philosophical principles were constantly applied, and one or two new principles ascertained."

There are few inventions of modern times that have been more directly the result of philosophical knowledge and experiment than the *safety-lamp*, invented by that accomplished chymist, the late Sir Humphrey Davy. He instituted a series of philosophical experiments, with the express purpose of constructing, if possible, a lamp by which the miner might walk through a body of fire-damp in his subterraneous apartments without danger of an explosion; and the success with which his investigations were attended led to one of the most beautiful and useful inventions which distinguish the period in which we live.* Had this ingenious philosopher been ignorant of the nature and properties of carburetted hydrogen gas, of the composition of atmospheric air, of the nature of combustion, and of the general principles of chymical science, he could never have hit upon the construction of this admirable instrument, and the useful miner would still have been left to grapple with his invisible enemy (the fire-damp) without any means of escaping from its destructive agency.†

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* See Appendix, No. IX.

† It is more than probable, that fatal accidents have occurred in coal-mines where these lamps have been used, owing to the ignorance and inattention of some of those artists who have been employed in forming the *wire-gauze* with which they are surrounded. A friend of mine, who performed a great variety of experiments with this instrument, with every combination of explosive gas, informed me, that, with a lamp surrounded with wire-gauze, manufactured by an artist in a town in the north of England, and *who supplied it for the use of the miners*—an explosion uniformly took place when the instrument was placed in a body of inflammable gas. He suspected that the apertures in the wire-gauze were too large, and remonstrated with the artist on his want of accuracy; and it was not before he procured gauze with smaller apertures that his experiments succeeded; and they were attended with complete success in every future experiment, after the gauze was changed. So small was the difference in the contexture of the two pieces of the gauze, that, to a common eye, it was scarcely perceptible. It is found by experiment, that the apertures in the gauze should not exceed one-twentieth of an inch square, and that wire from one-fortieth to one-sixtieth of an inch diameter is the most convenient. Had the artist alluded to known how to perform experiments with this instrument, and tried the effects of his gauze before he sold it for the purpose intended, such serious blunders would not have been committed. Who knows but the deficiency in the gauze alluded to might have been the cause of the destruction of several lives in the pits where it was used? for it is a certain fact that accidents from explosions are occasionally recurring, even in mines where these lamps are generally in use. Hence the necessity of chymical knowledge and attention to scientific accuracy in those who are the manufacturers of instruments of this description—on the accurate construction of which the

We may further remark, that the mechanic whose mind is enlightened with scientific knowledge *has a much greater chance of being instrumental in improving the arts than the mere chymist or philosopher*. While the mere philosopher is demonstrating principles and forming theories in his closet, and sometimes performing experiments, only on a *small* scale,—the workman, in certain manufactories, has a daily opportunity of contemplating chymical processes and mechanical operations on an *extensive* scale, and of perceiving numberless modifications and contrivances, which require to be attended to, of which the mere scientific speculator can form but a very faint and inadequate conception. Being familiar with the most minute details of every process and operation, he can perceive redundancies and defects imperceptible to other observers; and, if he has an accurate knowledge of the general principles on which his operations depend, he must be best qualified for suggesting and contriving the requisite improve-

lives and comforts of a useful body of the community may depend. I know not whether it be customary to put the safety-lamp into the hands of the miner, without first trying its efficiency for resisting the effects of explosive gases. If it is not, it is a most glaring and dangerous oversight; and there can be no question, that to the neglect of this precaution are to be attributed many of those explosions which have taken place in the mines where this lamp has been introduced. Besides, such neglects have a direct tendency to detract from the merits of this noble invention, to prevent its universal adoption, and to render uncertain its efficiency for warding off destructive explosions. But from the experiments alluded to above, which were performed with the greatest care, and with every possible combination of explosive gas, and frequently exhibited in private, and before large public audiences—the efficiency of this lamp for resisting the effects of fire-damp is put beyond the shadow of a doubt. It is known to be the practice of some miners occasionally to screw off the top of their lamp, in order to enjoy the benefit of more light than what shines through the wire-gauze. Such a practice ought to be strictly prohibited, and the instrument, if possible, rendered incapable of being opened at top—a practice which may probably have been the occasion of several explosions. If the workmen in mines were carefully instructed in the general principles of chymistry, and particularly in the nature of combustion, explosions, and the qualities of the different gases, they would not dare to hazard such dangerous experiments.

ments. As the mechanic is constantly handling the tools and materials with which new experiments and improvements may be made,—observing the effects of certain contrivances, and of deviations from established practice,—and witnessing the chymical and mechanical actions of bodies on each other,—he has more opportunities of observation in these respects, and, consequently, is more likely than any other class of society to strike out a new path which may lead to some useful invention in the arts, or discovery in the sciences.* But if his mind is not imbued with knowledge, he trudges on, like a mill-horse, in the same beaten track, and may overlook a thousand opportunities of performing experiments, and a thousand circumstances which might suggest new improvements.

In short, in so far as chance is concerned in new discoveries and improvements in the arts, the scientific mechanic has a hundred chances to one, compared with the ignorant artificer, that, in the course of his operations, he shall hit upon a new principle or improvement: his chances of such results are even superior to those of the most profound philosophers who never engage in practical operations, as he is constantly in the way of perceiving what is useless, defective, or in any way amiss in the common methods of procedure. To use a common expression, "he is in the way of good luck, and if he possesses the requisite information, he can take the advantage of it when it comes to him." And should he be so fortunate as to hit on a new invention, he will probably enjoy, not merely the honour which is attached to a new discovery, but also the pecuniary advantages which generally result from it.

We have, therefore, every reason to hope, that, were scientific knowledge universally diffused among the working classes, every department of the useful arts would proceed with a rapid progress to perfection; and new arts and inventions, hitherto unknown, be introduced on the theatre of the world, to increase the enjoyments of domestic society, and to embellish the face of nature. No possible limits can be assigned to the powers of genius, to the resources of science, to the improvement of machinery, to the aids to be derived from chymical researches, and to the skill and industry of mechanics and labourers when guided by the light which scientific discoveries have diffused around them. Almost every new discovery in nature lays the foundation of a new art; and since the recent discoveries of chymistry lead to the conviction, *that the properties and powers of material substances are only beginning to be discovered*—the resources of art must, in some measure, keep pace with our knowledge of the powers of nature. It is by seizing on these powers, and employing them in subserviency to his designs, that man has been enabled to perform operations which the whole united force of mere animal strength could never have accomplished. Steam, galvanism, the atmospheric pressure, oxygen, hydrogen, and other natural agents, formerly unnoticed or unknown, have been called into action by the genius of science; and, in the form of steam-boats and carriages, Voltaic batteries, gasometers, and air-balloons, have generated forces, effected decompositions, diffused the most brilliant illuminations, and produced a celerity of motion both on sea and land which have astonished even the philosophical world, and which former generations would have been disposed to ascribe to the agencies of infernal demons. And who shall dare to set boundaries to the range of scientific discovery—or to say, that principles and powers of a still more wonderful and energetic nature, shall not be discovered in the system of nature, calculated to perform achievements still more striking and magnificent? Much has, of late years, been performed by the application and combination of chymical and mechanical powers, but much more, we may confidently expect, will be achieved in generations yet to come, when the physical universe shall be more extensively explored, and the gates of the temple of knowledge thrown open to all. Future Watts, Davys, and Arkwrights will doubtless arise, with minds still more brilliantly illuminated with the lights of science; and the splendid inventions of the present age be far surpassed in the "future miracles of mechanic power," which will distinguish the ages which are yet to come. But, in order to this "wished-for consummation," it is indispensably requisite that the mass of mankind be aroused from their slumbers, that knowledge be universally diffused, and that the light of science shed its influence on men of every nation, of every profession, and of every rank. And if, through apathy or avarice, or indulgence in sensual propensities, we refuse to lend our helping hand to this object, now that a spirit of inquiry has gone abroad in the world—society may yet relapse into the darkness which enveloped the human mind during the middle ages, and the noble inventions of the past and present age, like the stately monuments of Grecian and Roman art, be lost amid the mists of ignorance, or blended with the ruins of empires.

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* See Appendix, No. X.

III. The knowledge and mental activity connected with the improvement of the arts *would promote the external comforts of mankind, particularly of the lower orders of society.*

Since the period when the arts began to be improved, and a spirit of inquiry after knowledge was excited among the middling and lower orders, many comforts and conveniences have been introduced, and a new lustre appears on the face of general society. In many places the aspect of the country has been entirely changed; the low thatched cottage of the farmer has arisen into a stately mansion, the noisome dunghill, which stood within two yards of his door, has been thrown into a spacious court at a distance from his dwelling, and his offices display a neatness and elegance which seem to vie with those of the proprietor of the soil. The gloomy parish church, with its narrow aisle and tottering belfrey, has been transformed into a noble lightsome edifice, and adorned with a stately spire towering above all surrounding objects; and the village school, within whose narrow walls a hundred little urchins were crowded, like sheep in a fold, has now expanded into a spacious hall. Narrow dirty paths have been improved, roads formed on spacious plans, canals and railways constructed, streets enlarged, waste lands cultivated, marshes drained, and the interior of houses decorated and rendered more comfortable and commodious. In districts where nothing formerly appeared but a dreary waste, print-fields have been established, cotton-mills, founderies, and other manufactories erected, villages reared, and the noise of machinery, the tolling of bells, the sound of hammers, the buzz of reels, and the hum of human voices and of ceaseless activity, now diversify the scene where nothing was formerly heard but the purling stream or the howlings of the tempest. In certain parts of the country where the passing of a chariot was a kind of phenomenon, mails and stage-coaches crowded with travellers of all descriptions, within and without, now follow each other in rapid succession, conveying their passengers with uninterrupted rapidity, and at one-half the expense formerly incurred. Even on the inland lake, where scarcely a small skiff was formerly seen, steam-vessels are now beheld sweeping along in majestic style, and landing fashionable parties, heroes, divines, and philosophers, to enliven the rural hamlet, the heath-clad mountain, and the romantic glen.

Much, however, is still wanting to complete the enjoyments of the lower ranks of society. In the *country*, many of them live in the most wretched hovels, open to the wind and rain, without a separate apartment to which an individual may retire for any mental exercise ; in *towns*, a whole family is frequently crowded into a single apartment in a narrow lane, surrounded with filth and noxious exhalations, and where the light of day is scarcely visible. In such habitations, where the kitchen, parlour, and bed-closet are all comprised in one narrow apartment, it is next to impossible for a man to improve his mind by reading or reflection, amid the gloom of twilight, the noise of children, and the preparation of victuals, even although he felt an ardent desire for intellectual enjoyment. Hence the temptation to which such persons are exposed to seek enjoyment in wandering through the streets, in frequenting the ale-house, or in lounging at the fireside in mental inactivity. In order that the labourer may be stimulated to the cultivation of his mental powers, he must be furnished with those domestic conveniences requisite for attaining this object. He must be paid such wages as will enable him to procure such conveniences, and the means of instruction, otherwise it is next thing to an insult to exhort him to prosecute the path of science. *The long hours of labour, and the paltry remuneration which the labourer receives in many of our spinning-mills* and other manufactories, so long as such domestic *slavery* and avaricious practices continue, *form an insurmountable barrier to the general diffusion of knowledge.*

But were the minds of the lower orders imbued with a certain portion of useful science, and did they possess such a competency as every human being ought to enjoy, their knowledge would lead them to habits of *diligence* and *econ-*

omy. In most instances it will be found that ignorance is the fruitful source of indolence, waste, and extravagance, and that abject poverty is the result of a want of discrimination and proper arrangement in the management of domestic affairs. Now, the habits of application which the acquisition of knowledge necessarily produces would naturally be carried into the various departments of labour peculiar to their stations, and prevent that laziness and inattention which is too common among the working classes, and which not unfrequently lead to poverty and disgrace. Their knowledge of the nature of heat, combustion, atmospheric air, and combustible substances would lead them to a proper economy in the use of fuel; and their acquaintance with the truths of chymistry, on which the art of a rational cookery is founded, would lead them to *an economical practice in the preparation of victuals*, and teach them to extract from every substance all its nutritious qualities, and to impart a proper relish to every dish they prepare; for want of which knowledge and attention, the natural substances intended for the sustenance of man will not go half their length in the hands of some as they do under the judicious management of others. Their knowledge of the structure and functions of the animal system, of the regimen which ought to be attended to in order to health and vigour, of the causes which produce obstructed perspiration, of the means by which pestilential effluvia and infectious diseases are propagated, and of the disasters to which the human frame is liable in certain situations, *would tend to prevent many of those diseases and fatal accidents* to which ignorance and inattention have exposed so many of our fellow-men. For want of attending to such precautions in these respects as knowledge would have suggested, thousands of families have been plunged into wretchedness and ruin, which all their future exertions were inadequate to remove. As the son of Sirach has well observed, "Better is the poor being sound and strong in constitution, than a rich man that is afflicted in his body. Health and good estate of body are above all gold; there are no riches above a sound body, and no joy above the joy of the heart."

As slovenliness and filth are generally the characteristics of ignorance and vulgarity, so an attention to *cleanliness* is one of the distinguishing features of cultivated minds.

Cleanliness is conducive to health and virtuous activity, but uncleanliness is prejudicial to both. Keeping the body clean is of great importance, since more than the one-half of what we eat or drink is evacuated by perspiration; and if the skin is not kept clean the pores are stopped, and perspiration consequently prevented, to the great injury of health. It is highly necessary to the health and cheerfulness of children; for where it is neglected, they grow pale, meager, and squalid, and subject to several loathsome and troublesome diseases. Washing the hands, face, mouth, and feet, and occasionally the whole body, conduces to health, strength, and ease, and tends to prevent colds, rheumatism, cramps, the palsy, the itch, the toothache, and many other maladies. Attention to cleanliness of body would also lead to cleanliness in regard to clothes, victuals, apartments, beds, and furniture. A knowledge of the nature of the mephitic gases, of the necessity of pure atmospheric air to health and vigour, and of the means by which infection is produced and communicated, would lead persons to see the propriety of frequently opening doors and windows to dissipate corrupted air, and to admit the refreshing breeze, of sweeping cobwebs from the corners and ceiling of the room, and of removing dust, straw, or filth of any kind which is offensive to the smell, and in which infection might be deposited. By such attention, fevers and other malignant disorders might be prevented, vigour, health, and serenity promoted, and the whole dwelling and its inmates present an air of cheerfulness and comfort, and become the seat of domestic felicity.

Again, scientific knowledge would display itself among the lower orders, in the tasteful *decoration of their houses and garden plots*. The study of botany and horticulture would teach them to select the most beautiful flowers, shrubs, and evergreens; to arrange their plots with neatness and taste, and to improve their kitchen-garden to the best advantage, so as to render it productive for the pleasure and sustenance of their families. A genius for mechanical operations, which almost every person may acquire, would lead them to invent a variety of decorations, and to devise many contrivances for the purpose of conveniency, and for keeping every thing in its proper place and order—which never enter into the conceptions of rude and vulgar minds. Were such dispositions and mental activity generally prevalent, the circumstances which lead to poverty, *beggary*, and drunkenness, would be in a great measure removed, and *home* would always be resorted to as a place of comfort and enjoyment.

Again, the study of science and art would incline the lower classes *to enter into the spirit of every new improvement, and to give their assistance in carrying it forward.* The want of taste and of mental activity, and the spirit of selfishness which at present prevail among the mass of mankind, prevent the accomplishment of a variety of schemes which might tend to promote the conveniences and comforts of general society. For example: many of our villages, which might otherwise present the appearance of neatness and comfort, are almost impassable, especially in the winter season, and during rainy weather, on account of the badness of roads and the want of footpaths. At almost every step you encounter a pool, a heap of rubbish, or a dunghill, and in many places feel as if you were walking in a quagmire. In some villages, otherwise well planned, the streets present a grotesque appearance of sandy hillocks and mounds, and pools of stagnant water scattered in every direction, with scarcely the vestige of a pathway to guide the steps of the passenger. In winter, the traveller, in passing along, is bespattered with mire and dirt; and in summer, he can only drag heavily on, while his feet at every step sink into soft and parched sand. Now, such is the apathy and indifference that prevail among many villagers as to improvement in these respects, that although the contribution of a single shilling, or of half a day's labour, might, in some instances, accomplish the requisite improvements, they will stand aloof from such operations with a sullen obstinacy, and even glory in being the means of preventing them. Nay, such is the selfishness of many individuals, that they will not remove nuisances even from the front of their own dwellings, because it might at the same time promote the convenience of the public at large. In large towns, likewise, many narrow lanes are rendered filthy, gloomy, and unwholesome by the avarice of landlords, and the obstinate and boorish manners of their tenants, and improvements prevented which would tend to the health and comfort of the inhabitants. But as knowledge tends to liberalize the mind, to subdue the principle of selfishness, and to produce a relish for cleanliness and comfort, when it is more generally diffused, we may expect that such improvements as those to which I allude will be carried forward with spirit and alacrity. There would not be the smallest difficulty in accomplishing every object of this kind, and every other improvement conducive to the pleasure and comfort of the social state, provided the majority of a community were cheerfully to come forward with their assistance and contributions, however small, and to act with concord and harmony. A whole community or nation acting in unison, and every one contributing according to his ability, would accomplish wonders in relation to the improvement of towns, villages, and hamlets, and of every thing that regards the comfort of civil and domestic society.

In short, were knowledge generally diffused, and art uniformly directed by the principles of science, new and interesting plans would be formed, new improvements set on foot, new comforts enjoyed, and a new lustre would appear on the face of nature, and on the state of general society. Numerous conveniences, decorations, and useful establishments never yet attempted would soon be realized. Houses on neat and commodious plans, in airy situations, and furnished with every requisite accommodation, would be reared for the use of the peasant and mechanic; schools on spacious plans for the promotion of useful knowledge would be erected in every village and hamlet, and in every quarter of a city where they were found expedient; asylums would be built for the reception of the friendless poor, whether young or old; manufactories established for supplying employment to every class of labourers and artisans, and lecture-rooms prepared, furnished with requisite apparatus, to which they might resort for improvement in science. Roads would be cut in all convenient directions, diversified with rural decorations, hedge-rows, and shady bowers,—foot-paths, broad and smooth, would accompany them in all their windings,—and gas-lamps, erected at every half-mile's distance, would variegate the rural scene and cheer the shades of night. Narrow lanes in cities would be either widened or their houses demolished; streets on broad and spacious plans would be built, the smoke of steam-engines consumed, nuisances removed, and cleanliness and comfort attended to in every arrangement. Cheerfulness and activity would everywhere prevail; and the idler, the vagrant, and the beggar would disappear from society. All these operations and improvements, and hundreds more, could easily be accomplished, were the minds of the great body of the community *thoroughly enlightened and moralized*, and every individual, whether rich or poor, who contributed to bring them into effect, would participate in the general enjoyment. And what an interesting picture would be presented to every benevolent mind, to behold the great body of mankind raised from a state of moral and physical degradation to the dignity of their rational natures, and to the enjoyment of the bounties of their Creator!—to behold the country diversified with the neat and cleanly dwellings of the industrious labourer,—the rural scene, during the day, adorned with seminaries, manufactories, asylums, stately edifices, gardens, fruitful fields, and romantic bowers; and during night bespangled in all directions with variegated lamps, forming a counterpart, as it were, to the lights which adorn the canopy of heaven! Such are only a few specimens of the improvements which art, directed by science and morality, could easily accomplish.

SECTION VI.

On the Influence of Knowledge in promoting enlarged Conceptions of the Character and Perfections of the Deity.

ALL the works of God speak of their Author in silent but emphatic language, and declare the glory of his perfections to all the inhabitants of the earth. But, although "there is no speech nor language" where the voice of Deity is not heard, how gross are the conceptions generally entertained of the character of Him "in whom we live and move," and by whose superintending providence all events are directed! Among the greater number of pagan nations, the most absurd and grovelling notions are entertained respecting the Supreme Intelligence, and the nature of that worship which his perfections demand. They have formed the most foolish and degrading representations of this august Being, and have "changed the glory of the incorruptible God into an image made like to corruptible man, and to four-footed beasts and creeping things." Temples have been erected, and filled with idols the most hideous and obscene; bulls and crocodiles, dogs and serpents, goats and lions have been exhibited to adumbrate the character of the Ruler of the universe. The most cruel and unhallowed rites have been performed to procure his favour, and human victims sacrificed to appease his indignation. All such grovelling conceptions and vile abominations have their origin in the darkness which overspreads the human understanding, and the depraved passions which ignorance has a tendency to produce. Even in those countries where revelation sheds its influence, and the knowledge of the true God is promulgated, how mean and contracted are the conceptions which the great bulk of the population entertain of the attributes of that incomprehensible Being whose presence pervades the immensity of space, "who metes out the heavens with a span," and superintends the affairs of ten thousand worlds." The views which many have acquired of the perfections of the Deity do not rise much higher than those which we ought to entertain of the powers of an archangel, or of one of the seraphim; and some have been known, even in our own country, whose conceptions have been so abject and grovelling, as to represent to themselves "the King eternal, immortal, and invisible" under the idea of a "venerable old man." Even the more intelligent class of the community fall far short of the ideas they ought to form of the God of heaven, owing to the limited views they have been accustomed to take of the displays of his wisdom and benevolence, and the boundless range of his operations.

We can acquire a knowledge of the Deity only by the visible effects he has produced, or the *external manifestations* he has given of himself to his creatures; for the Divine Essence must remain for ever inscrutable to finite minds. These manifestations are made in the Revelations contained in the Bible, and in the scene of the material universe around us. The *moral* perfections of God, such as his justice, mercy, and faithfulness, are more particularly delineated in his Word; for of these the system of nature can afford us only some slight hints and obscure intimations. His natural attributes, such as his immensity, omnipotence, wisdom, and goodness, are chiefly displayed in the works of creation; and to this source of information the inspired writers uniformly direct our attention, in order that we may acquire the most ample and impressive views of the grandeur of the Divinity, and the magnificence of his operations. "Lift up your eyes on high and behold! who hath created these orbs? who bringeth forth their host by number? The everlasting God the Lord, by the greatness of his might, for that he is strong in power. He measureth the ocean in the hollow of his hand, he comprehends the dust of the earth in a measure, he weigheth the mountains in scales, and hath stretched out the heavens by his understanding. All nations before him are as the drop of a bucket, and are counted to him less than nothing, and vanity. Thine, O Lord, is the greatness, and the glory, and the majesty, for all that is in heaven and earth is thine." The pointed interrogatories proposed to Job,* and the numerous exhortations in reference to this subject, contained in the book of Psalms and other parts of Scripture, plainly evince, that the character of God is to be contemplated through the medium of his visible works. In order to acquire a just and comprehensive conception of the perfections of Deity, we must contemplate his character as displayed both in the system of Revelation and in the system of nature, otherwise we can acquire only a partial and distorted view of the attributes of Jehovah. The Scriptures alone, without the medium of his works, cannot convey to us the most sublime conceptions of the magnificence of his empire, and his eternal power and Godhead; and the works of nature, without the revelations of his Word, leave us in profound darkness with regard to the most interesting parts of his character—the plan of his moral government, and the ultimate destination of man.

Would we, then, acquire the most sublime and comprehensive views of that invisible Being, who created the universe, and by whom all things are upheld, we must, in the first place, apply ourselves, with profound humility and reverence, to the study of the *Sacred Oracles*; and, in the next place, direct our attention to the material works of God as *illustrative* of his Scriptural character, and of the declarations of his Word. And, since the sacred writers direct our views to the operations of the Almighty in the visible universe, *in what manner* are we to contemplate these operations? Are we to view them in a careless, cursory manner, or with fixed attention? Are we to gaze on them with the vacant stare of a savage, or with the penetrating eye of a Christian philosopher? Are we to view them through the mists of ignorance and vulgar prejudice, or through the light which science has diffused over the wonders of creation? There can be no difficulty to any reflecting mind in determining which of these modes ought to be adopted. The Scriptures declare, that as "the works of Jehovah are *great*," they must be "*sought out*," or thoroughly investigated, "by all those who have pleasure therein;" and a threatening is denounced against every one who "disregards the works of the Lord," and "neglects to *consider* the operations of his hand."

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* Job, ch. xxxviii. &c.

Such declarations evidently imply, that we ought to make the visible works of God the subject of our serious study and investigation, and exercise the rational powers he has given us for this purpose; otherwise we cannot expect to derive from them a true and faithful exhibition of his character and purposes. For, as the character of God is impressed upon his works, that character cannot be distinctly traced unless those works be viewed in their *true light* and actual relations—not as they may appear to a rude and inattentive spectator, but as they are actually found to exist, when thoroughly examined by the light of science and of revelation. For example, a person unaccustomed to investigate the system of nature imagines that the earth is a *fixed* mass of land and water in the midst of creation, and one of the largest bodies in nature, and, consequently, that the sun, moon, and stars, and the whole material universe revolve around it every twenty-four hours. Such a conception of the material system might, indeed, convey to the mind an astonishing idea of the *power* of the Deity in causing such an immense number of orbs to revolve around our world with so prodigious a velocity as behooved to take place, were the earth in reality a quiescent body in the centre of the universe. But it would give us a most strange and distorted idea of his *intelligence*. While it tended to magnify his *omnipotence*, it would, in effect, deprive him of the attribute of *wisdom*. For, in the first place, such a conception would represent the Almighty as having devised a system of means altogether superfluous and preposterous, in order to accomplish the end intended; for it is the characteristic of wisdom to proportionate the means to the nature of the design which is to be accomplished. The design, in the case under consideration, is to produce the alternate succession of day and night. This can be effected by giving the earth itself a rotation round its axis, as is the case in other globes of much larger dimensions. But according to the conception to which we are now adverting, *the whole material creation* is considered as daily revolving around this comparatively little globe of earth, an idea altogether extravagant and absurd, and inconsistent with every notion we ought to entertain of infinite wisdom. In the next place, were the earth considered as at rest, the motions of the planets would present a series of looped curves without any marks of design, a scene of inextricable confusion, and the whole of the solar system would appear devoid of order and harmony, and, consequently, without the marks of wisdom and intelligence. So that when the arrangements of nature are contemplated through the mists of ignorance, they tend to obscure the glory of the Divinity, and to convey a *distorted* idea of his character. Whereas, when the system of the universe is contemplated in its true light, all appears arranged with the most admirable harmony, simplicity, and order, and every mean proportionate to the end it is intended to accomplish. Again, in so far as we consider the earth as the principal body, or among the largest bodies of the universe, in so far do we narrow our conceptions of the extent and magnificence of creation, and, consequently, limit our views of the plans and perfections of the Creator. For our conceptions of his attributes must, in some measure, correspond to the views we have acquired of the amplitude and grandeur of his empire.

Now, what is it that enables us to investigate the works of God, and to contemplate the system of nature *in its true light?* It is *Science* combined with observation and experiment. And what is science, considered in a theological point of view? It is nothing else than a rational inquiry into the arrangements and operations of the Almighty, in order to trace the perfections therein displayed. And what are the truths which science has discovered? They may be regarded as so many rays of celestial light descending from the Great Source of Intelligence to illuminate the human mind in the knowledge of the Divine character and government, and to stimulate it to still more vigorous exertions in similar investigations, just as the truths of revelation are so many emanations from the "Father of lights," to enlighten the darkness and to counteract the disorders of the *moral* world; and both these lights must be resorted to to direct our inquiries, if we wish to attain the clearest and most comprehensive views of the attributes of the Divine mind. Revelation declares, in so many distinct propositions, the character of God, and the plans of his moral government. Science explains and illustrates many of those subjects to which revelation refers. It removes the veil from the works of the Creator; it dispels the mists which ignorance and superstition have thrown around them; it conducts us into the secret chambers of nature, and discloses to us many of those hidden springs which produce the diversified phenomena of the material world; it throws a light on those delicate and minute objects which lie concealed from the vulgar eye, and brings within the range of our contemplation the distant glories of the sky; it unveils the laws by which the Almighty directs the movements of his vast empire, and exhibits his operations in a thousand aspects, of which the unenlightened mind can form no conception. If, then, science throws a light on the works and the ways of God, the acquisition of scientific knowledge, when properly directed, must have a tendency to direct our conceptions and to amplify our views of his adorable attributes, and of his providential arrangements.

Here it will naturally be inquired,—What are some of those views of the Divine character which scientific investigation has a tendency to unfold? Our limits will not permit a full and explicit answer to this inquiry, the illustration of which would require a volume of no inconsiderable size; and therefore we shall attempt nothing more than the statement of a few general hints.

1. The phenomena of the material world, as investigated by science, evince the *unity* of the Divine Being. There is

such a *harmony* that prevails through the whole visible universe, as plainly shows it to be under the government of *one* Intelligence. Amid the immense complication that surrounds us we perceive *one set* of laws uniformly operating, in accordance with which all things proceed in their regular courses. The same causes uniformly produce the same effects in every region of the world, and in every period of time. "Vegetables spring from the same seed, germinate by the same means, assume the same form, sustain the same qualities, exist through the same duration, and come to the same end." Animals, too, of the same species, are brought into existence in the same manner, exhibit the same life and vital functions, display the same active powers and instinct, and hasten to the same dissolution. Man has one origin, one general form, the same corporeal structure, the same vital functions, the same system of intellectual faculties, and comes to the same termination. All the elements around him, and every arrangement in this sublunary sphere, are made, in one regular manner, subservient to his sensitive enjoyment, and are evidently fitted, by one design, and directed by one agency, to promote his happiness. The connexion and harmony which subsist between the animal and vegetable kingdoms, plainly evince that *one* and the same Being is the former of both; and that in his contrivances with respect to the one, he had in view the necessities of the other. We know, that different sorts of plants, herbs, and flowers are appointed for food to the several tribes of animals. That which is hurtful to one species is salutary to another. One creature climbs the highest rocks for herbs, another digs in the earth for roots, and we scarcely know a plant or leaf but what affords nourishment and a place of nativity to some species or other of the insect tribes. This is the foundation of innumerable relations and connexions between these two departments of creation, which show the work to be *one*, and the result of the same *Power* and *Intelligence*. In like manner, day and night uniformly return with the utmost regularity, and by the operation of the same cause; and with the same regularity and harmony the seasons revolve and appear in constant succession. The composition of the atmosphere is the same under every latitude, and light and heat are diffused by the same law in every region of the earth. One law causes a stone to fall to the ground; and by the operation of the same law, the moon is retained in her orbit around the earth, the planets directed in their revolutions around the sun, and the whole universe compacted into one harmonious system. In short, all the arrangements and operations of nature, so far as our knowledge extends, present to our view a single design, regularly executed by a single agency. The fair inference, therefore, is, that every part of the world in which we dwell, and every department of the solar system, are under the government of *one Intelligence*, which directs every movement throughout the universal system. And the more extensively our views of the universe are enlarged, the marks of unity in operation and design become more strikingly apparent. Now, if two or more intelligences had the government of the universe in their hands, and if they had equal power and contrary designs, their purposes would clash, and they could never become the parents of that harmony which we clearly perceive throughout the system of nature. Thus the operations of the visible world confirm and illustrate the declaration of the inspired oracles, that "*there is none other God but one.*"

2. A scientific investigation of the material world opens to us innumerable evidences of *Divine Wisdom.*

Wherever we turn our eyes in the visible world around us, and survey with attention the various processes of nature, we perceive at every step the most striking marks of intelligence and design. We perceive the wisdom of the great Author of nature, in the admirable constitution of the atmosphere, and the wonderful properties of the constituent principles of which it is composed,—in the motions of *light*, the inconceivable smallness of its particles, its adaptation to the eye, and the admirable manner in which vision is performed,—in the nature of *sound*, the laws by which it is propagated, and the various modifications of which it is susceptible,—in the process of evaporation, and the rains, dews, and fertility which are the results of this admirable part of the economy of nature,—in the utility of the mountains and valleys with which the earth is diversified, and the beautiful colouring which is spread over the face of nature,—in the morning and evening *twilight*, and the gradual approaches of light and darkness,—in the vast expanse of the *ocean* and its numerous productions,—in the grand, and picturesque, and beautiful landscapes with which our globe is adorned, in the composition and specific gravity of *water*, and in the peculiar structure and density of the solid parts of the earth,—in the expansion of water in the act of freezing, and the nature and properties of heat and flame,—in the power of *steam*, the properties of the gases, the qualities of the magnet, and the agencies of the galvanic and electric fluids,—in the structure of *vegetables*, the adaptation of their seeds, roots, fibres, vessels, and leaves to the purpose of vegetative life,—the curious processes which are continually going on in their internal parts, their delicate contexture and diversified hues, and the important purposes they serve in the system of nature,—in the structure of the various *animated beings* which traverse the air, the waters, and the earth,—the provision made for the continuance of the species, their architective faculties, their wonderful instincts, and the *infinite diversity of organisation* which appears among them, *suited to their various wants and modes of existence*,—in the admirable organization of the *human frame*, the numerous bones, muscles, ligaments, membranes, arteries, and veins which enter into its construction, the apt disposition of all its parts, the means contrived for the reception and distribution of nutriment, the effect which this nutriment produces in bringing the body to ts full growth and expansion,—its self-restoring power when diseased or wounded, the provision made against evil accidents and inconveniences, the variety of muscular movements of which it is susceptible, the process of respiration, the circulation of the blood, the separation of the chyle, the exquisite structure of the different senses, and the nice adaptation of every organ and movement to the ends it was intended to subserve. The same wisdom is perceptible in the position which the sun holds in the solar system, in order to a due distribution of light and heat to surrounding worlds; in the distance at which the earth is placed from this luminary,—in the order and harmony of all the celestial motions, and in the wonderful and beautiful scenery, invisible to the unassisted eye, which the microscope displays, both in the animal and vegetable world. In short, there is not an object within us or around us, in the mountains or the plains, in the air, the ocean, or the sky,—among the animal or the vegetable tribes, when steadily contemplated in all its aspects and relations, but displays to the eye of reason and devotion the consummate intelligence and skill of its almighty Author, and calls upon every intelligent agent, in silent but emphatic language, to praise him "who made the earth, the sea, the fountains of water, and all that live in them, for whose pleasure they are and were created."

Let us just select one example out of the many thousands which might be brought forward on this subject. This example shall be taken from an *invisible* department of nature. In consequence of modern scientific discovery, it has been ascertained that the atmosphere, or the air we breathe, is compounded of two invisible substances, termed *oxygen* gas and *nitrogen* gas. Oxygen, as formerly stated, is the principle of vitality and combustion; nitrogen is destructive both to flame and animal life. Were we to breathe oxygen by itself, it would cause our blood to circulate with greater rapidity, but it would soon waste and destroy the human frame by the rapid accumulation of heat. Were the nitrogen to be extracted from the atmosphere, and the oxygen left to exert its native energies, it would melt the hardest substances, and set the earth in flames. If the oxygen were extracted and the nitrogen only remained, every species of fire and flame would be extinguished, and all the tribes of animated nature instantly destroyed. The proportion of these two gases to each other is nearly as *one* to *four*. Were this proportion materially altered, a fluid might be produced which would cause a burning pain and instantaneous suffocation. The *specific gravity* of these two substances is nearly as 37 to 33; that is, the nitrogen is a small degree *lighter* than the oxygen. Were this proportion reversed, or, in other words, were the oxygen of the atmosphere a small degree lighter than the nitrogen, so that the nitrogen might become a little heavier than common air,—as this gas is thrown off continually by the breathing of men and other animals,—it would perpetually occupy the lower regions of the atmosphere, and be productive of universal pestilence and death. Again, oxygen gas is separated from the nitrogen in the lungs; it is absorbed by the blood, and gives it its *red* colour, and is the source of animal heat throughout the whole system. It forms the basis of all the acids; it pervades the substance of the vegetable tribes, and enables them to perform their functions, and it forms a constituent part of the water which fills our rivers, seas, and oceans. And as the atmosphere is daily liable to be deprived of this fluid by combustion, respiration, and other processes, the leaves of trees and other vegetables give out a large portion of it during the day, which, uniting with the nitrogen gas thrown off by the breathing of animals, keeps up the equilibrium, and preserves the salubrity of the air in which we move and breathe.

These facts demonstrate the infinite knowledge and the consummate *wisdom* of the Contriver of the universe,—in the exquisitely nice adjustment of every minute circumstance, so as to preserve the balance of nature and secure the happiness of his sensitive and intelligent offspring. What an all-comprehensive intelligence does it indicate in the Divine Mind, to cause one single principle in different combinations to produce so immense a variety of important effects! What dreadful havoc would be produced throughout the whole of our sublunary system, if a substance like oxygen gas, which pervades every part of nature, *were not nicely balanced and proportioned!* All nature might soon be thrown into confusion, and all the tribes of the living world either be reduced to misery or swept into the tomb. A material difference in the proportion of the two airs which compose the atmosphere might be productive of the most dreadful and destructive effects. One of the most corrosive acids, *aquafortis*, is composed of 75 parts oxygen and 25 parts nitrogen. Were this the proportion of these fluids in the atmosphere, every breath we drew would produce the most excruciating pain, and, after two or three inspirations, the vital powers would be overcome, and life extinguished. Here then we perceive an *admirable adjustment of means to ends*, and an evidence of that comprehensive knowledge which penetrates into the energies of all substances, and foresees all the consequences which can follow from the principles and laws of nature, in every combination and in every mode of their operation. This is only one instance out of a thousand which the researches of science afford us of the admirable economy of the wisdom of God. From ignorance of such facts, the bulk of mankind are incapable of appreciating the blessings they enjoy, under the arrangements of Infinite Wisdom, and unqualified for rendering a grateful homage to Him "in whom they live, and move, and have their being."

3. The contemplation of nature through the medium of science affords innumerable displays of the *benevolence* of the Deity. Benevolence, or goodness, is that perfection of God which leads him, in all his arrangements, to communicate happiness to every order of his creatures. This attribute, though frequently overlooked, is so extensively displayed throughout the scene of creation, that we feel at a loss to determine from what quarter we should select instances for its illustration. Wherever we find evidences of wisdom and design, we also find instances of benevolence; for all the admirable contrivances we perceive in the system of nature have it as their ultimate end to convey pleasure, in one shape or another, to sensitive beings. If there are more than 240 bones in the human body, variously articulated, and more than 440 muscles, of different forms and contextures, such a structure is intended to produce a thousand modifications of motion in the several members of which it is composed, and to facilitate every operation we have occasion to perform. If the ear is formed with an external porch, a hammer, an anvil, a tympanum, a stirrup, and a labyrinth, this apparatus is intended to convey pleasure to the soul by communicating to it all the modifications of sound. If the *eye* is composed of three coats, some of them opaque and some transparent, with three humours of different forms and refractive powers, and a numerous assemblage of minute veins, arteries, *muscles*, nerves, glands, and lymphatics, it is in order that the images of objects may be accurately depicted on the retina, that the ball of the eye may be easily turned in every direction, and that we may enjoy all the entertainments of vision.* If an atmosphere

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* As an evidence of the care of the Creator to promote our enjoyment, the following instance may be selected in regard to the *muscles* of the eye. Nothing can be more manifestly an evidence of contrivance and design, and at the same time of benevolent intention, than these muscles, which are admirably adapted to move the ball of the eye in every direction, upwards, downwards, to the right-hand, to the left, and in whatever direction we please, so as to preserve that parallelism of the eye which is necessary to distinct vision. In *Fig*. I is exhibited the eyeball with its muscles; *a*, is the optic nerve: *b*, the *musculus*

is thrown around the earth, it is for the purpose of attempering the rays of the sun, giving a lucid brightness to every part of the heavens, producing the morning and even-

Fig. 1.

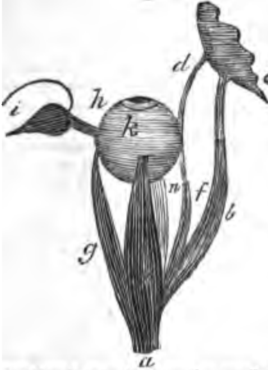
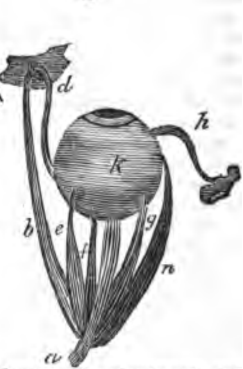


Fig. 2.



trochlearis, which turns the pupil downwards and outwards, and enables the ball of the eye to roll about at pleasure; *c*, is part of the *os frontis*, to which the trochlea or pulley is fixed, through which *d*, the tendon of the trochlearis, passes; *e*, is the *attolens oculi*, for raising up the globe of the eye; *n*, the *depressor oculi*, for pulling the globe of the eye down; *f*, *adductor oculi*, for turning the eye towards the nose; *g*, *abductor oculi*, for moving the globe of the eye outwards, to the right or left; *h*, *obliquus inferior*, for drawing the globe of the eye forwards, inwards, and downwards; *i*, part of the superior maxillary bone, to which it is fixed; *k*, the eyeball. *Fig.* 2 represents the same muscles in a different point of view, where the same letters refer to the same muscles.

All these opposite and antagonist muscles preserve a nice equilibrium, which is effected partly by their equality of strength, partly by their peculiar origin, and partly by the natural posture of the body and the eye, by which means the eye can be turned instantaneously towards any object, preserved in perfect steadiness, and prevented from rolling about in hideous contortions. This is only *one* out of a hundred instances in relation to the eye, in which the same benevolent design is displayed.

ing twilight, promoting evaporation and the respiration of animals, and causing the earth to bring forth abundance of food, by means of the rains and dews; all which effects produce happiness in a thousand different ways to every sentient being. If this atmosphere presses our bodies with a weight of thirty thousand pounds, it is in order to counterpoise the internal pressure of the circulating fluids, and to preserve the vessels and animal functions in due tone and vigour, without which pressure the elastic fluids in the finer vessels would inevitably burst them, and the spark of life be quickly extinguished. Thousands of examples of this description, illustrative of Divine benevolence, might be selected from every part of the material system connected with our world, all of which would demonstrate, that the communication of enjoyment is the great end of all the contrivances of Infinite Wisdom.

There is a striking display of benevolence in *the gratification afforded to our different senses*. As the eye is constructed of the most delicate substances, and is one of the most admirable pieces of mechanism connected with our frame, so the Creator has arranged the world in such a manner as to afford it the most varied and delightful gratification. By means of the solar light, which is exactly adapted to the structure of this organ, thousands of objects of diversified beauty and sublimity are presented to the view. It opens before us the mountains, the vales, the woods, the lawns, the brooks and rivers, the fertile plains and flowery fields, adorned with every hue,—the expanse of the ocean and the glories of the firmament. And as the eye would be dazzled were a deep *red* colour or a brilliant *white* to be spread over the face of nature, the Divine goodness has clothed the heavens with *blue* and the earth with *green*, the two colours which are the least fatiguing and the most pleasing to the organs of sight, and at the same time one of these colours is diversified by a thousand delicate shades which produce a delightful *variety* upon the landscape of the world. The ear is curiously constructed for the perception of sounds, which the atmosphere is fitted to convey; and what a variety of pleasing sensations are produced by the objects of external nature intended to affect this organ! The murmurings of the brooks, the whispers of the gentle breeze, the hum of bees, the chirping of birds, the lowing of the herds, the melody of the feathered songsters, the roarings of a stormy ocean, the dashings of a mighty cataract, and, above all, the numerous modulations of the human voice and the harmonies of music, produce a variety of delightful emotions which increase the sum of human enjoyment. To gratify the sense of *smelling*, the air is perfumed with a variety of delicious odours, exhaled from innumerable plants and flowers. To gratify the *feeling*, pleasing sensations of various descriptions are connected with almost every thing we have occasion to touch; and to gratify the sense of *taste*, the earth is covered with an admirable profusion of plants, herbs, roots, and delicious fruits of thousands of different qualities and flavours, calculated to convey an agreeable relish to the inhabitants of every clime. Now, it is easy to conceive that these gratifications were not necessary to our *existence*. The purposes of vision, as a mere animal sensation for the use of self-preservation, might have been answered, although every trace of beauty and sublimity had been swept from the universe, and nothing but a vast assemblage of dismal and haggard objects had appeared on the face of nature. The purpose of hearing might have been effected although every sound had been grating and discordant, and the voice of melody for ever unknown. We might have had smell without fragrance or perfume; taste without variety of flavour; and feeling, not only without the least pleasing sensation, but accompanied with incessant pain. But, in this case, the system of nature would have afforded no direct proofs, as it now does, of Divine benevolence.

The remedies which the Deity has provided against the evils to which we are exposed are likewise a proof of his benevolence. Medicines are provided for the cure of the diseases to which we are liable; heat is furnished to deliver us from the effects of cold; rest from the fatigues of labour; sleep from the languors of watching; artificial light to preserve us from the gloom of absolute darkness, and shade from the injuries of scorching heat. Goodness is also displayed in the power of *self-restoration* which our bodies possess in recovering us from sickness and disease, in healing wounds and bruises, and in recovering our decayed organs of sensation, without which power almost every human being would present a picture of deformity and a body full of scars and putrifying sores. The pupil of the eye is so constructed, that it is capable of contracting and dilating by a sort of instinctive power. By this means the organ of vision defends itself from the blindness which might ensue from the admission of too great a quantity of light; while, on the other hand, its capacity of expansion, so as to take in a greater quantity of rays, prevents us from being in absolute darkness even in the deepest gloom, without which we could scarcely take a step with safety during a cloudy night. Again, in the construction of the human body, and of the various tribes of animated beings, however numerous and complicated their organs, there is no instance can be produced that any one muscle, nerve, joint, limb, or other part is contrived *for the purpose of producing pain.* When pain is felt, it is uniformly owing to some derangement of the corporeal organs, but is never the necessary result of the original contrivance. On the other hand, every part of the construction of living beings, every organ and function, and every contrivance, however delicate and minute, in so far as its use is known, is found to contribute to the enjoyment of the individual to which it belongs, either by facilitating its movements, by enabling it to ward off dangers, or in some way or another to produce agreeable sensations.

In short, *the immense multitude of animated beings which people the earth, and the ample provision which is made for their necessities,* furnish irresistible evidence of Divine goodness. It has been ascertained that more than sixty thousand species of animals inhabit the air, the earth, and the waters, besides many thousands which have not yet come within the observation of the naturalist. On the surface of the earth there is not a patch of ground or a portion of water, a single shrub, tree, or herb, and scarcely a single leaf in the forest, but what teems with animated beings. How many hundreds of millions have their dwellings in caves, in the clefts of rocks, in the bark of trees, in ditches, in marshes, in the forests, the mountains and the valleys! What innumerable shoals of fishes inhabit the ocean and sport in the seas and rivers! What millions on millions of birds and flying insects, in endless variety, wing their flight through the atmosphere above and around us! Were we to suppose that each species, at an average, contains four hundred millions of individuals, there would be 24,000,000,000,000, or

24 billions of living creatures belonging to all the known species which inhabit the different regions of the world—besides the multitudes of unknown species yet undiscovered,—which is *thirty thousand times* the number of all the human beings that people the globe.* Besides these, there are

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* As an instance of the *immense number* of animated beings, the following facts in relation to two species of birds may be stated. Captain Flinders, in his voyage to Australasia, saw a compact stream of stormy petrels, which was from 50 to 80 yards deep and 300 yards or more broad. This stream, for a full hour and a half, continued to pass without interruption with nearly the swiftness of the pigeon. Now, taking the column at 50 yards deep by 300 in breadth, and that it moved 30 miles an hour, and allowing nine cubic inches of space to each bird, the number would amount to 151 millions and a half. The migratory pigeon of the United States flies in still more amazing multitudes. Wilson, in his "American Ornithology," says, "Of one of these immense flocks, let us attempt to calculate the numbers, as seen in passing between Frankfort on the Kentucky and the Indian territory. If we suppose this column to have been one mile in breadth, and I believe it to have been much more, and that it moved four hours at the rate of one mile a minute, the time it continued in passing would make the whole length 240 miles. Again, supposing that each square yard of this moving body comprehended three pigeons, the square yards multiplied by 3 would give 2,230,272,000," that is, two thousand two hundred and thirty millions and two hundred and seventy-two thousand, nearly three times the number of all the human inhabitants of the globe, but which Mr. Wilson reckons to be far below the actual amount. Were we to estimate the number of animals by the scale here afforded, it would amount to several hundreds or thousands of times more than what I have stated in the text. For if a single flock of the pigeons now alluded to in only one district of the earth, amounts to so prodigious a number, how many thousand times more must be the amount of the same species in all the regions of the globe! In the above calculations, it is taken for granted that pigeons fly at the rate of from 30 to 60 miles an hour, and it is found by actual experiment that this is the case. In 1830, 110 pigeons were brought from Brussels to London, and were let fly on the 19th July, at a quarter before nine A. M. One reached Antwerp, 186 miles' distance, at 18 minutes past 2, or in 5½ hours, being at the rate of 34 miles an hour. Five more reached the same place within eight minutes afterward, and thirteen others in the course of eight hours after leaving London. Another went from London to Maestricht, 260 miles, in six hours and a quarter, being at the rate of nearly 42

multitudes of animated beings which no man can number invisible to the unassisted eye, and dispersed through every region of the earth, air, and seas. In a small stagnant pool which in summer appears covered with a green scum, there are more microscopic animalcules than would outnumber all the inhabitants of the earth. How immense then must be the collective number of these creatures throughout every region of the earth and atmosphere! It surpasses all our conceptions. Now, it is a fact that, from the elephant to the mite, from the whale to the oyster, and from the eagle to the gnat, or the microscopic animalcula, no animal can subsist without nourishment. Every species, too, requires a different kind of food. Some live on grass, some on shrubs, some on flowers, and some on trees. Some feed only on the roots of vegetables, some on the stalk, some on the leaves, some on the fruit, some on the seed, some on the whole plant; some prefer one species of grass, some another. Linnæus has remarked, that the cow eats 276 species of plants, and rejects 218; the goat eats 449, and rejects 126; the sheep eats 387, and rejects 141; the horse eats 262, and rejects 212; and the hog, more nice in its taste than any of these, eats but 72 plants, and rejects all the rest. Yet such is the unbounded munificence of the Creator, that all these countless myriads of sentient beings are amply provided for and nourished by his bounty! "The eyes of all these look unto Him, and he openeth his hand and satisfieth the desire of every living being." He has so arranged the world, that every place affords the proper food for all the living creatures with which it abounds. He has furnished them with every organ and apparatus of instruments for the gathering, preparing, and digesting of their food, and has endowed them with admirable sagacity in finding out and providing their nourishment, and in enabling them to distinguish

miles an hour. The golden eagle sweeps through the atmosphere at the rate of 40 miles an hour, and it has been computed that the swift flies, at an average, 500 miles a day, and yet finds time to feed, to clean itself, and to collect materials for its nest with apparent leisure. Such are the numbers of this species of animated beings, and such the powers of rapid motion which the Creator has conferred upon them,—powers which man, with all his intellectual faculties and inventions, has never yet been able to attain.

between what is salutary and what is pernicious. In the exercise of these faculties, and in all their movements, they appear to experience a happiness suitable to their nature. The young of all animals in the exercise of their newly-acquired faculties—the fishes sporting in the waters, the birds skimming beneath the sky and warbling in the thickets, the gamesome cattle browsing in the pastures, the wild deer bounding through the forests, the insects gliding through the air and along the ground, and even the earth-worms wriggling in the dust,—proclaim, by the vivacity of their movements and their various tones and gesticulations, that the exercise of their powers is connected with *enjoyment*. In this boundless scene of beneficence we behold a striking illustration of the declarations of the inspired writers, that "the Lord is good to all,"—that "the earth is full of his riches,"—and that "his tender mercies are over all his works."

Such are a few evidences of the benevolence of the Deity as displayed in the arrangements of the material world. However plain and obvious they may appear to a reflecting mind, they are almost entirely overlooked by the bulk of mankind, owing to their ignorance of the facts of natural history and science, and the consequent inattention and apathy with which they are accustomed to view the objects of the visible creation. Hence they are incapacitated for appreciating the beneficent character of the Creator, and the riches of his munificence; and incapable of feeling those emotions of admiration and *gratitude* which an enlightened contemplation of the scene of nature is calculated to inspire.

4. An enlightened and comprehensive survey of the universe presents to us *a view of the vast multiplicity of conceptions and the infinitely diversified ideas which have been formed in the Divine Mind.*

As the conceptions existing in the mind of an artificer are known by the instruments he constructs, or the operations he performs, so the ideas which have existed from eternity in the mind of the Creator are ascertained from the objects he has created, the events he has produced, and the operations he is incessantly conducting. The formation of a single object is an exhibition of the *idea* existing in the Creating Mind, of which it is a copy. The formation of a second or a third object exactly resembling the first would barely exhibit the same ideas a second or a third time, without disclosing any thing *new* concerning the Creator; and, consequently, our conceptions of his intelligence would not be enlarged, even although thousands and millions of such objects were presented to our view,—just as a hundred clocks and watches, exactly of the same kind, constructed by the same artist, give us no higher idea of his *skill* and *ingenuity* than the construction of one. But every *variety* in objects and arrangements exhibits a new discovery of the plans, contrivances, and intelligence of the Creator.

Now in the universe we find all things constructed and arranged on the plan of *boundless and universal variety.* In the animal kingdom there have been actually ascertained, as already noticed, about sixty thousand *different species* of living creatures. There are about 600 species of *mammalia*, or animals that suckle their young, most of which are quadrupeds—4000 species of *birds*, 3000 species of *fishes*, 700 species of *reptiles*, and 44,000 species of insects.* Besides these, there are about 3000 species of *shellfish*, and perhaps not less than eighty or a hundred thousand species of animalcules invisible to the naked eye; and new species are daily discovering, in consequence of the zeal and industry of the lovers of natural history. As the system of animated nature has never yet been thoroughly explored, we might safely reckon the number of species of animals of all kinds as amounting to at least *three hundred thousand.* We are next to consider that the organical structure of each species consists of an immense multitude of parts, and that all the species are infinitely diversified—differing from each other in their forms, organs, members, faculties, and motions. They are of all shapes and sizes, from the microscopic animalculum, ten thousand times less than a mite, to the elephant and the whale. They are different in respect of the construction of their sensitive organs. In regard to the *eye*, some have this organ placed in the front, so as to look directly forward, as in man; others have it so placed as to take in nearly a whole hemisphere, as in birds, hares, and conies; some have it fixed, and others moveable; some have *two* globes or balls, as quadrupeds; some have *four*, as snails, which are fixed in their horns; some have *eight*, set like a locket of diamonds, as spiders; some have several *hundreds*, as flies and beetles, and others above *twenty thousand*, as the dragon-fly and several species of butterflies. In regard to the *ear*,—some have it large, erect, and open, as in the hare, to hear the least approach of danger; in some it is covered to keep out noxious bodies; and in others, as in the mole, it is lodged deep and backward in the head, and fenced and guarded from external injuries. With regard to their *clothing*,—some have their bodies covered with hair, as quadrupeds; some with feathers, as birds; some with scales, as fishes; some with shells, as the tortoise; some only with skin; some with stout and firm armour, as the rhinoceros; and others with prickles, as the hedgehog and porcupine—all nicely accommodated to the nature of the animal and the element in which it lives. These coverings, too, are adorned with *diversified* beauties; as appears in the plumage of birds, the feathers of the peacock, the scales of the finny tribes, the hair of quadrupeds, and the variegated polish and colouring of the tropical shellfish—beauties which, in point of symmetry, polish, texture, variety, and exquisite colouring, mock every attempt of human art to copy or to imitate.

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* Specimens of all these species are to be seen in the magnificent collections in the Museum of Natural History at Paris.

In regard to *respiration*—some breathe through the mouth by means of lungs, as men and quadrupeds; some by means of gills, as fishes; and some by organs placed in other parts of their bodies, as insects. In regard to the *circulation of the blood*, some have but one ventricle in the heart, some two, and others three. In some animals the heart throws its blood to the remotest parts of the system; in some it throws it only into the respiratory organs; in others, the blood from the respiratory organs is carried by the veins to another heart, and this second heart distributes the blood by the channel of its arteries to the several parts. In many insects, a number of hearts are placed at intervals on the circulating course, and each renews the impulse of the former where the momentum of the blood fails. In regard to *the movements of their bodies*—some are endowed with swift motions, and others with slow; some walk on two legs, as fowls; some on four, as dogs; some on eight, as caterpillars; some on a hundred, as scolopendræ or millepedes; some on fifteen hundred and twenty feet, as one species of sea-star; and some on two thousand feet, as a certain species of echinus.* Some glide along with a sinuous motion on scales, as snakes and serpents; some skim through the air, one species on two wings, another on four; and some convey themselves with speed and safety by the help of their webs, as spiders; while others glide with agility through the waters by means of their tails and fins. But it would require volumes to enumerate and explain all the known varieties which distinguish the different species of animated beings. Besides the varieties of the species, there are not, perhaps, of all the hundreds of millions which compose any one species, two individuals precisely alike in every point of view in which they may be contemplated.

As an example of the numerous parts and functions which enter into the construction of an animal frame, it may be stated, that in the human body there are 445 bones, each of them having *forty* distinct scopes or intentions; and 246 muscles, each having *ten* several intentions; so that the system of bones and muscles alone includes above 14,200 varieties, or different intentions and adaptations. But, besides the bones and muscles, there are hundreds of *tendons* and *ligaments* for the purpose of connecting them together; hundreds of *nerves* ramified over the whole body to convey sensation to all its parts; thousands of arteries to convey the blood to the remotest extremities, and thousands of *veins* to bring it back to the heart; thousands of *lacteal* and *lymphatic* vessels to absorb nutriment from the food; thousands of *glands* to secrete humours from the blood, and of *emunctories* to throw them off from the system—and, besides many other parts of this variegated system, and functions with which we are unacquainted, there are more than *sixteen hundred millions* of membranous cells or *vesicles* connected with the *lungs*, more than *two hundred thousand millions* of pores in the skin, through which the perspiration is incessantly flowing, and above a *thousand millions* of scales, which, according to Leeuwenhoek, Baker, and others, compose the cuticle or outward covering of the body. We have also to take into the account the compound organs of life, the numerous parts of which they consist, and the diversified functions they perform; such as the *brain*, with its infinite number of fibres and numerous functions; the *heart*, with its auricles and ventricles; the stomach, with its juices and muscular coats; the *liver*, with its lobes and glands; the *spleen*, with its infinity of cells and membranes; the *pancreas*, with its juice and numerous glands; the *kidneys*, with their fine capillary tubes; the *intestines*, with all their turnings and convolutions; the *organs of sense*, with their multifarious connexions; the mesentery, the gall-bladder, the ureters, the pylorus, the duodenum, the blood, the bile, the lymph, the saliva, the chyle, the hairs, the nails, and numerous other parts and substances, every one of which has diversified functions to perform. We have also to take into consideration *the number of ideas included* in the *arrangement and connexion* of all these parts, and in the manner in which they are *compacted* into one system of small dimensions, so as to afford free scope for all the intended functions. If, then, for the sake of a rude calculation, we were to suppose, in addition to the 14,200 adaptations stated above, that there are 10,000 veins great and small, 10,000 arteries, 10,000 nerves,* 1000 ligaments, 4000 lacteals and lymphatics, 100,000 glands, 1,600,000,000 vesicles in the lungs, 1,000,000,000 scales, and 200,000,000,000 of pores, the amount would be 202,600,149,200 different parts and adaptations in the human body; and if all the other species were supposed to be differently organized, and to consist of a similar number of parts, this number multiplied by 300,000, the supposed number of species—the product would amount to 60,780,044,760,000,000, or above sixty thousand billions,—the number of distinct ideas, conceptions, or contrivances, in relation to the animal world—a number of which we can have no precise conception, and which, to limited minds like ours, seems to approximate to something like infinity; but it may tend to convey a rude idea of the endless multiplicity of conceptions which pervade the Eternal Mind.

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* See Lyonet's notes to Lesser's *Insecto-theology*, who also mentions that these *echini* have 1300 horns, similar to those of snails, which they can put out and draw in at pleasure.

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* The amazing extent of the ramification of the veins and nerves may be judged of from this circumstance, that neither the point of the smallest needle, nor the infinitely finer lance of a gnat can pierce any part without drawing blood, and causing an uneasy sensation, consequently without wounding, by so small a puncture, both a nerve and a vein; and therefore the number of these vessels here assumed may be considered as far below the truth.

That many other tribes of animated nature have an organization no less complicated and diversified than that of man will appear from the following statements of M. Lyonet. This celebrated naturalist wrote a treatise on one single insect, the *cossus caterpillar*, which lives on the leaves of the willow,—in which he has shown, from the anatomy of that minute animal, that its structure is almost as complicated as that of the human body, and many of the parts which enter into its organization even more numerous. He has found it necessary to employ *twenty* figures to explain the organization of the *head*, which contains 228 different muscles. There are 1647 muscles in the body, and 2066 in the intestinal tube; making in all 3941 muscles, or nearly *nine* times the number of muscles in the human body. There are 94 principal *nerves* which divide into *innumerable ramifications*. There are two large tracheal arteries, one at the right and the other at the left side of the insect, each of them communicating with the air by means of nine spiraculà. Round each spiraculum the trachea pushes forth a great number of branches, which are again divided into smaller ones, and these further subdivide and spread through the whole body of the caterpillar: they are naturally of a silver colour, and make a beautiful appearance. The principal tracheal vessels divide into 1326 different branches. All this complication of delicate machinery, with numerous other parts and organs, are compressed into a body only about two inches in length.

Were we to direct our attention to the *vegetable* kingdom, we might contemplate a scene no less variegated and astonishing than what appears in the animal world. There have already been discovered more than *fifty-six thousand* species of plants, specimens of all which may be seen in the Museum of Natural History at Paris. But we cannot reckon the actual number of species in the earth and seas at less than *four or five hundred thousand.* They are of all sizes, from the invisible forests which are seen in a piece of mouldiness, by the help of the microscope, to the cocoas of Malabar fifty feet in circumference, and the banians, whose shoots cover a circumference of five acres of ground. Each of them is furnished with a complicated system of vessels for the circulation of its juices, the secretion of its odours, and other important functions somewhat analogous to those of animals. Almost every vegetable consists of a root, trunk, branches, leaves, skin, bark, pith, sap-vessels, or system of arteries and veins, glands for perspiration, flowers, petals, stamina, farina, seed-case, seed, fruit, and various other parts; and these are different in their construction and appearance in the different species. Some plants, as the oak, are distinguished for their strength and hardness; others, as the elm and fir, are tall and slender; some are tall, like the cedar of Lebanon, while others never attain to any considerable height; some have a rough and uneven bark, while others are smooth and fine, as the birch, the maple, and the poplar; some are so slight and delicate that the least wind may overturn them, while others can resist the violence of the northern blasts; some acquire their full growth in a few years, while others grow to a prodigious height and size, and stand unshaken amid the lapse of centuries; some drop their leaves in autumn, and remain for months like blighted trunks, while others retain their verdure amid the most furious blasts of winter; some have leaves scarcely an inch in length or breadth, while others, as the *tallipot* of Ceylon, have leaves so large that one of them, it is said, will shelter fifteen or twenty men from the rain.

The variety in the vegetable kingdom in respect of *flowers* is apparent even to the least attentive observer. Every species is different from another in the form and hues which it exhibits. The carnation differs from the rose, the rose from the tulip, the tulip from the auricula, the auricula from the lily, the lily from the narcissus, and the ranunculus from the daisy. At the same time, each ranunculus, daisy, rose, or tulip has its own particular character and beauty, something that is peculiar to itself, and in which it is distinguished from its fellows. In a bed of ranunculuses or tulips, for example, we shall scarcely find two individuals that have precisely the same aspect, or present the same assemblage of colours. Some flowers are of a stately size, and seem to reign over their fellows in the same parterre, others are lowly or creep along the ground; some exhibit the most dazzling colours, others are simple and blush almost unseen; some perfume the air with exquisite odours, while others only please the sight with their beautiful tints. Not only the forms and colours of flowers, but their *perfumes*, are different. The odour of southernwood differs from that of thyme, that of peppermint from balm, and that of the daisy from the rose, which indicates a variety in their internal structure, and in the juices that circulate within them. The *leaves* of all vegetables, like the skin of the human body, are diversified with a multitude of extremely fine vessels, and an astonishing number of *pores*. In a kind of box-tree called *Palma Cereres*, it has been observed that there are above *a hundred and seventy-two thousand* pores on one single side of the leaf. In short, the whole earth is covered with vegetable life in such profusion and variety as astonishes the contemplative mind. Not only the fertile plains, but the rugged mountains, the hardest stones, the most barren spots, and even the caverns of the ocean, are diversified with plants of various kinds; and, from the torrid to the frigid zone, every soil and every climate has plants and flowers peculiar to itself. To attempt to estimate their number and variety would be to attempt to dive into the depths of infinity. Yet every diversity in the species, every variety in the form of the individuals, and even every difference in the shade and combination of colour in flowers of the same species, exhibits a distinct conception which must have existed in the Divine Mind before the vegetable kingdom was created.

Were we to take a survey of the *mineral* kingdom, we should also behold a striking exhibition of the "*manifold* wisdom of God." It is true, indeed, that we cannot penetrate into the interior recesses of the globe, so as to ascertain the substances which exist, and the processes which are going on near its central regions. But, within a few hundreds of fathoms of its surface, we find such an astonishing diversity of mineral substances, as clearly shows that its internal parts have been constructed on the same plan of *variety* as that of the animal and vegetable kingdoms. In the classes of *earthy*, *saline*, *inflammable*, and *metallic* fossils, under which mineralogists have arranged the substances of the mineral kingdom, are contained an immense number of genera and species. Under the *earthy* class of fossils are comprehended diamonds, chrysolites, menilites, garnets, zeolites, corundums, agates, jaspers, opals, pearl-stones, tripoli, clay-slate, basalt, lava, chalk, limestone, selenite, strontian, barytes, celestine, and various other substances.

The *saline* class comprehends such substances as the following,—natron or natural soda, rock-salt, nitre, alum, sal-ammoniac, Epsom salt, &c. The class of *inflammable* substances comprehends sulphur, carbon, bitumen, coal, amber, charcoal, naphtha, petroleum, asphalt, caoutchouc, mineral tar, &c. The *metallic* class comprehends platina, gold, silver, mercury, copper, iron, lead, tin, bismuth, zinc, antimony, cobalt, nickel, manganese, molybdenum, arsenic, scheele, menachanite, uran, silvan chromium, tungsten, uranium, titanium, tellurium, sodium, potassium, &c. All these mineral substances are distinguished by many varieties of species. There are *eight genera* of earthy fossils. One of these genera, the *flint*, contains 34 species, besides numerous varieties, such as chrysoberyls, topazes, agates, beryls, quartz, emery, diamond spar, &c. Another genus, the *clay*, contains 32 species, such as opal, pitch-stone, felspar, black chalk, mica, hornblende, &c.; and another, the *calc*, contains 20 species, as limestone, chalk, slate, spar, fluor, marle, boracite, loam, &c. There are ten species of *silver*, five of *mercury*, seventeen of *copper*, fourteen of *iron*, ten of *lead*, six of antimony, three of bismuth, &c. All the bodies of the mineral kingdom differ from one another as to figure, transparency, hardness, lustre, ductility, texture, structure, feel, sound, smell, taste, gravity, and their magnetical and electrical properties; and they exhibit almost every variety of colour. Some of those substances are soft and pulverable, and serve as a bed for the nourishment of vegetables, as black earth, chalk, clay, and marl. Some are solid, as lead and iron; and some are fluid, as mercury, sodium, and potassium. Some are brittle, as antimony and bismuth, and some are malleable, as silver and tin. Some are subject to the attraction of the magnet, others are conductors of the electric fire; some are easily fusible by heat, others will resist the strongest heat of our common fires. Some are extremely ductile, as *platina*, the heaviest of the metals, which has been drawn into wires less than the two-thousandth part of an inch in diameter,—and *gold*, the parts of which are so fine and expansible that an ounce of it is sufficient to gild a silver wire more than 1300 miles long.

In order to acquire the most impressive idea of the mineral kingdom, we must visit an extensive mineralogical museum, where the spectator will be astonished both at the beauty and the infinite diversity which the Creator has exhibited in this department of nature. Here it may be also noticed, that not only the external aspect of minerals, but also the *interior configuration* of many of them, displays innumerable beauties and varieties. A rough dark-looking pebble, which to an incurious eye appears only like a fragment of common rock, when cut asunder and polished, presents an assemblage of the finest veins and most brilliant colours. If we go into a lapidary's shop, and take a leisurely survey of his jaspers, topazes, cornelians, agates, garnets, and other stones, we cannot fail to be struck with admiration, not only at the exquisite polish and the delicate wavings which their surfaces present, but at the variety of design and colouring exhibited even by individuals of the same species, the latent beauties and diversities of which require the assistance of a microscope to discern, and are beyond the efforts of the most exquisite pencil fully to imitate.

Not only in the objects which are visible to the unassisted eye, but also *in those which can only be perceived by the help of microscopes*, is the characteristic of *variety* to be seen. In the scales of fishes, for example, we perceive an infinite number of diversified specimens of the most curious workmanship. Some of these are of a longish form, some round, some triangular, some square; in short, of all imaginable variety of shapes. Some are armed with sharp prickles, as in the perch and sole; some have smooth edges, as in the tench and codfish; and even in the same fish there is a considerable variety; for the scales taken from the belly, the back, the sides, the head, and other parts are all different from each other. In the scale of a perch we perceive one piece of delicate mechanism, in the scale of a haddock another, and in the scale of a sole beauties different from both. We find some of them ornamented with a prodigious number of concentric flutings, too near each other and too fine to be easily enumerated. These flutings are frequently traversed by others diverging from the centre of the scale, and proceeding from thence in a straight line to the circumference. On every fish there are many thousands of these variegated pieces of mechanism. The hairs on the bodies of all animals are found, by the microscope, to be composed of a number of *extremely minute tubes*, each of which has a round bulbous root, by which it imbibes its proper nourishment from the adjacent humours, and these are all different in different animals. Hairs taken from the head, the eyebrows, the nostrils, the beard, the hand, and other parts of the body, are unlike to each other, both in the construction of the roots and the hairs themselves—and appear as varied as plants of the same genus but of different species. The parts of which the *feathers* of birds are composed afford a beautiful variety of the most exquisite workmanship. There is scarcely a feather but contains a million of distinct parts, every one of them regularly shaped. In a small fibre of a goose-quill, more than 1200 downy branches or small leaves have been counted on each side, and each appeared divided into 16 or 18 small joints. A small part of the feather of a peacock, one-thirtieth of an inch in length, appears no less beautiful than the whole feather does to the naked eye, exhibiting a multitude of bright shining parts, reflecting first one colour and then another in the most vivid manner. The *wings* of all kinds of insects, too, present an infinite variety, no less captivating to the mind than pleasing to the eye. They appear strengthened and distended by the finest bones, and covered with the lightest membranes. Some of them are adorned with neat and beautiful feathers, and many of them provided with the finest articulations and foldings for the wings, when they are withdrawn and about to be folded up in their cases. The thin membranes of the wings appear beautifully divaricated with thousands of little points, like silver studs. The wings of some flies are *filmy*, as the dragon-fly; others have them stuck over with short *bristles*, as the flesh-fly; some have rows of feathers along their ridges, and borders round their edge, as in gnats; some have hairs and others have hooks placed with the greatest regularity and order. In the wings of moths and butterflies there are millions of small feathers of different shapes, diversified with the greatest variety of bright and vivid colours, each of them so small as to be altogether invisible to the naked eye.

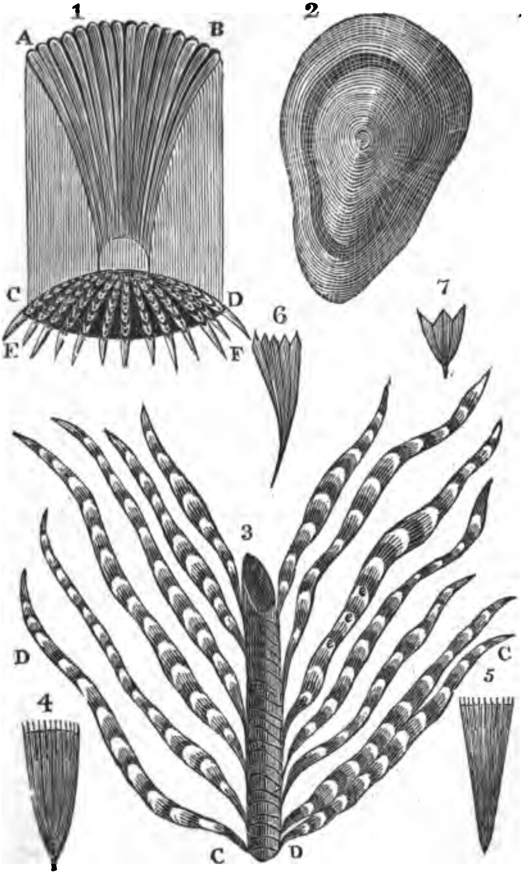
The *leaves* of all plants and flowers, when examined by the microscope, are found to be full of innumerable ramifications that convey the perspirable juices to the pores, and to consist of parenchymous and ligneous fibres, interwoven in a curious and admirable manner. The smallest leaf, even one which is little more than visible to the naked eye, is found to be thus divaricated, and the variegations are different in the leaves of different vegetables.—*A transverse section of a plant* not more than one-fourth of an inch in diameter displays such beauties and varieties, through a powerful microscope, as cannot be conceived without ocular inspection. The number of pores, of all sizes, amounting to hundreds of thousands (which appear to be the vessels of the plant cut asunder), the beautiful curves they assume, and the radial and circular configurations they present, are truly astonishing; and every distinct species of plants exhibits a different configuration. I have counted in a small section of a plant, of the size now stated, 5000 radial lines, each containing about 250 pores, great and small, which amounts to *one million two hundred and fifty thousand* of these variegated apertures. —Even *the particles of sand* on the seashore, and on the banks of rivers, differ in the size, form, and colour of their grains; some being transparent, others opaque—some having rough and others smooth surfaces; some are spherical or oval, and some pyramidal, conical, or prismatical. Mr. Hook, happening to view some grains of white sand through his microscope, hit upon one of the grains which was exactly shaped and wreathed like a shell, though it was no larger than the point of a pin. "It resembled the shell of a small water-snail, and had twelve wreathings, all growing proportionably one less than the other towards the middle or centre of the shell, where there was a very small round white spot." This gives us an idea of the existence of shellfish which are invisible to the naked eye, and consequently smaller than a mite.

The variety of forms in which *animal life* appears, in those invisible departments of creation which the microscope has enabled us to explore, is truly wonderful and astonishing. Microscopic animals are so different from those of the larger kinds, that scarcely any analogy seems to exist between them; and one would be almost tempted to suppose that they lived in consequence of laws directly opposite to those which preserve man and the other larger animals in existence. When we endeavour to explore this region of animated nature, we feel as if we were entering on the confines of a new world, and surveying a new race of sentient existance. The number of these creatures exceeds all human calculation. Many hundreds of species, all differing in their forms, habits, and motions, have already been detected and described, but we have reason to believe, that by far the greater part is unexplored, and perhaps for ever hid from the view of man. They are of all shapes and forms: some of them appear like minute atoms, some like globes and spheroids, some like hand-bells, some like wheels turning on an axis, some like double-headed monsters, some like cylinders, some have a worm-like appearance, some have horns, some resemble eels, some are like long hairs, 150 times as long as they are broad, some like spires and cupolas, some like fishes, and some like animated vegetables. Some of them are almost visible to the naked eye, and some so small that the breadth of a human hair would cover fifty or a hundred of them, and others so minute that millions of millions of them might be contained within the compass of a square inch. In every pond and ditch, and almost in every puddle, in the infusions of pepper, straw, grass, oats, hay, and other vegetables, in paste and vinegar, and in the water found in oysters, on almost every plant and flower, and in the rivers, seas, and oceans, these creatures are found in such numbers and variety as almost to exceed our conception or belief. A class of these animals, called *Medusæ*, has been found so numerous as to discolour the ocean itself. Captain Scoresby found the number in the olive-green sea to be immense. A cubic inch contained sixty-four, and consequently a cubic mile would contain 23,888,000,000,000,000; so that, if one person should count a million in seven days, it would have required that 80,000 persons should have started at the creation of the world to have completed the enumeration at the present time. Yet, all the minute animals to which we now allude are furnished with numerous organs of life as well as the larger kind, some of their internal movements are distinctly visible, their motions are evidently *voluntary*, and some of them appear to be possessed of a considerable degree of sagacity, and to be fond of each other's society.*

* The following extract from Mr. Baker's description of the *hair-like animalcule* will illustrate some of these positions. A small quantity of the matter containing these animalcules having been put into a jar of water, it so happened that one part went down immediately to the bottom, while the other continued floating on the top. When things had remained for some time

In short, it may be affirmed without the least hesitation, that the beauties and *varieties* which exist in those regions of creation which are invisible to the unassisted eye are far more numerous than all that appears to a common observer in the visible economy of nature. How far this scene of creating power and intelligence may extend beyond the range of our microscopic instruments, it is impossible for mortals to determine; for the finer our glasses are, and the higher the magnifying powers we apply, the more numerous and varied are the objects which they exhibit to our view. And as the largest telescope is insufficient to convey our views to the boundaries of the great universe, so we may justly conclude that the most powerful microscope that has been or ever will be constructed will be altogether insufficient to guide our views to the utmost limits of the descending scale of creation. But what we already know of these unexplored and inexplorable regions gives us an amazing conception of the intelligence and wisdom of the Creator, of the immensity of his nature, and of the infinity of ideas which, during every portion of past duration, must have been present before his all-comprehensive mind. What an immense space in the scale of animal life intervenes between an *animalcule*, which appears only the size of a visible point, when magnified 500,000 times, and a *whale*, a hundred feet long and twenty broad! The proportion of bulk between the one of these beings and the other is nearly as 34,560,000,000,000,000,000 to 1. Yet all the intermediate space is filled up with animated beings of every form and order! A similar variety obtains in the vegetable kingdom. It has been calculated, that some plants which grow on *rose* leaves,

in this condition, each of these swarms of animalcules began to grow weary of its situation, and had a mind to change its quarters. Both armies, therefore, set out at the same time, the one proceeding upwards and the other downwards; so that after some time they met in the middle. A desire of knowing how they would behave on this occasion engaged the observer to watch them carefully; and to his surprise, he saw the army that was marching upwards open to the right and left, to make room for those that were descending. Thus, without confusion or intermixture, each held on its way; the army that was going up marching in two columns to the top, and the other proceeding in one column to the bottom, as if each had been under the direction of wise leaders.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and other shrubs, are so small that it would require more than a thousand of them to equal in bulk a single plant of *moss*; and if we compare a stem of moss, which is generally not above one-sixtieth of an inch, with some of the large trees in Guinea and Brazil of twenty feet diameter, we shall find the bulk of the one will exceed that of the other no less than 2,985,984,000,000 times, which multiplied by 1000 will produce 2,985,984,000,000,000, the number of times which the large tree exceeds the rose-leaf plant. Yet this immense interval is filled up with plants and trees of every form and size! With good reason, then, may we adopt the language of the inspired writers,—"How *manifold* are thy works, O Lord! In wisdom hast thou made them all. O the depth of the riches both of the wisdom and the knowledge of God! Marvellous things doth He which we cannot comprehend."*

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* The figures of microscopical objects contained in the engravings Nos. I. and II. will convey a rude idea of some of the objects to which I have now alluded.

No. I. *Fig.* 1, represents the *scale* of a *sole-fish* as it appears through a good microscope. CDEF represents that part of the scale which appears on the outside of the fish, and ABCD the part which adheres to the skin, being furrowed, that it may hold the faster. It is terminated by pointed spikes, every alternate one being longer than the interjacent ones. *Fig.* 2 is the scale of a haddock, which appears divaricated like a piece of network. *Fig.* 3 represents a small portion or fibre of the *feather of a peacock*, only one-thirtieth of an inch in extent, as it appears in the microscope. The small fibres of these feathers appear, through this instrument, no less beautiful than the whole feather does to the naked eye. Each of the sprigs or hairs on each side of the fibre, as CD, DC, appears to consist of a multitude of bright shining parts, which are a congeries of small plates, as *ees*, &c. The under sides of each of these plates are very dark and opaque, reflecting all the rays thrown upon them like the foil of a looking-glass; but their upper sides seem to consist of a multitude of exceedingly thin plated bodies, lying close together, which, by various positions of the light, reflect first one colour and then another, in a most vivid and surprising manner. *Fig.* 4, 5, 6, 7, represent some of the different kinds of feathers which constitute the dust which adheres to the wings of moths and butterflies, and which, in the microscope, appear tinged with a variety of colours. Each of these feathers is an object so small as to be scarcely perceptible to the naked eye.

Even the *external aspect of nature*, as it appears to a superficial observer, presents a scene of *variety*. The ranges

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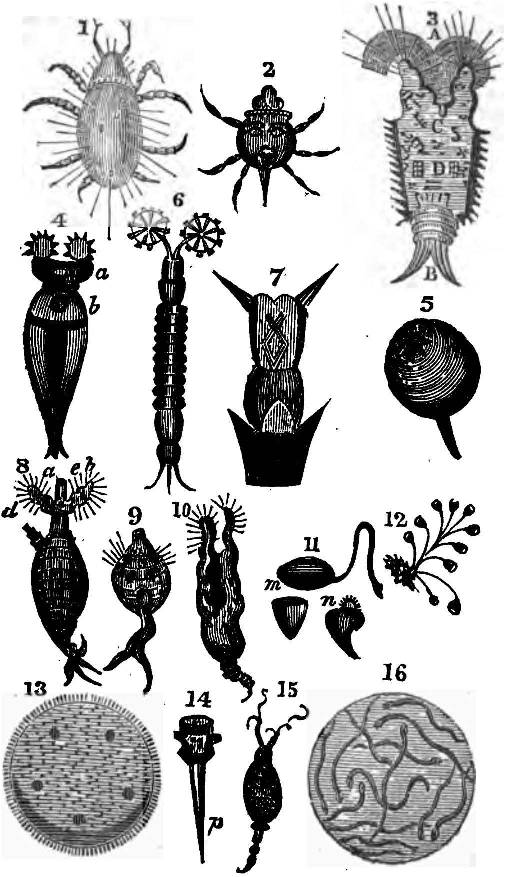
Explanation of the figures on No. II.—*Fig.* 1 represents a *mite*, which has eight legs, with five or six joints in each, two feelers, a small head in proportion to its body, a sharp snout and mouth like that of a mole, and two little eyes. The body is of an oval form, with a number of hairs like bristles issuing from it, and the legs terminate in two hooked claws. *Fig.* 2 represents a microscopic animal which was found in an infusion of *anemony*. The surface of its back is covered with a fine mask, in the form of a *human face*; it has three feet on each side, and a tail which comes out from under the mask. *Fig.* 3 is an animalcula found in the infusion of *old hay*. A shows the head, with the mouth opened wide, and its lips furnished with numerous hairs; B is its forked tail, D its intestines, and C its heart, which may be seen in regular motion. The circumference of the body appears indented like the teeth of a saw. *Fig.* 4 shows the *Wheel-animal* or *Vorticella*. It is found in rain-water that has stood some days in leaden gutters, or in hollows of lead on the tops of houses. The most remarkable part of this animalcula is its *wheel-work*, which consists of two semicircular instruments, round the edges of which many little fibrillæ move themselves very briskly, sometimes with a kind of rotation, and sometimes in a trembling or vibratory manner. Sometimes the wheels seem to be entire circles, with teeth like those of the balance-wheel of a watch; but their figure varies according to the degree of their protrusion, and seems to depend upon the will of the animal itself; *a* is the head and wheels, *b* is the *heart*, where its systole and diastole are plainly visible, and the alternate motions of contraction and dilatation are performed with great strength and vigour, in about the same time as the pulsation of a man's artery. This animal assumes various shapes, one of which is represented at *Fig.* 5, and becomes occasionally a case for all the other parts of the body.

Fig. 6 represents *an insect with net-like arms.* It is found in cascades where the water runs very swift. Its body appears curiously turned as on a lathe, and at the tail are three sharp spines, by which it raises itself and stands upright in the water; but the most curious apparatus is about its head, where it is furnished with two instruments, like fans or nets, which serve to provide its food. These it frequently spreads out and draws in again, and, when drawn up, they are folded together with the utmost nicety and exactness. When this creature does not employ its nets, it thrusts out a pair of sharp horns, and puts on a different appearance, as in *Fig.* 7, where it is shown magnified about 400 times. *Fig.* 8 is the representation of an animalcula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of mountains with summits of different heights and shapes, the hills and plains, the glens and dells, the waving curves

found in the infusion of *the bark of an oak*. Its body is composed of several ringlets, that enter one into another, as the animal contracts itself. At *ab*, are two lips furnished, with moveable hairs; it pushes out of its mouth a *snout* composed of several pieces sheathed in each other, as at *e*. A kind of horn *d* is sometimes protruded from the breast, composed of furbelows, which slide into one another like the drawers of a pocket telescope. *Fig*. 9 is another animalcula, found in the same infusion, called a *tortoise*, with an umbilical tail. It stretches out and contracts itself very easily, sometimes assuming a round figure, which it retains only for a moment, then opens its mouth to a surprising width, forming nearly the circumference of a circle. Its motion is very surprising and singular. *Fig*. 10 is an animalcula, called *great mouth*, which is found in several infusions. Its mouth takes up half the length of its body; its inside is filled with darkish spots, and its hinder part terminated with a singular tail. *Fig*. 11 represents the *proteus*, so named on account of its assuming a great number of different shapes. Its most common shape bears a resemblance to that of a swan, and it swims to and fro with great vivacity. When it is alarmed, it suddenly draws in its long neck, transforming itself into the shape represented at *m*, and at other times it puts forth a new head and neck with a kind of wheel machinery, as at *n*. *Fig*. 12 exhibits a species of animalcula shaped like bells with long tails, by which they fasten themselves to the roots of *duck-weed*, in which they were found. They dwell in colonies, from ten to fifteen in number. *Fig*. 13 is the *globe animal*, which appears exactly globular, having no appearance of either head, tail, or fins. It moves in all directions, forwards or backwards, up or down, either rolling over and over like a bowl, spinning horizontally like a top, or gliding along smoothly without turning itself at all. When it pleases, it can turn round, as it were upon an axis very nimbly, without removing out of its place. It is transparent, except where the circular black spots are shown; it sometimes appears as if dotted with points, and beset with short moveable hairs or bristles, which are probably the instruments by which its motions are performed. *Fig*. 14 shows a species of animalculæ called *soles*, found in infusions of straw and the ears of wheat; *o* is the mouth, which is sometimes extended to a great width, *p* is the tail. *Fig*. 15 represents an animal found in an infusion of citron flowers. Its head is very short, and adorned with two horns like those of a deer; its body appears to be covered with scales, and its tail long, and swift in motion. *Fig*. 16 represents the *eels* which are found in paste and stale which appear on the face of every landscape, the dark hues of the forests, the verdure of the fields, the towering cliffs, the rugged precipices, the rills, the rivers, the cataracts, the lakes and seas; the gulfs, the bays and peninsulas; the numerous islands of every form and size which diversify the surface of the ocean, and the thousands of shades of colouring which appear on every part of sublunary nature, present a scene of diversified beauty and sublimity to the eye of every beholder.—And if we lift our eyes to the regions of the firmament, we likewise behold a scene of sublimity and grandeur, mingled with variety. The sun himself appears diversified with spots of various shapes and sizes, some a hundred, some a thousand, and some ten thousand miles in diameter—indicating operations and changes of amazing extent—and almost every new revolution on his axis presents us with new and varied clusters. Every planet in the solar system differs from another in its size, in its spheroidal shape, in its diurnal rotation, in the aspect of its surface, in the constitution of its atmosphere, in the number of moons with which it is surrounded, in the nature of its seasons, in its distance from the sun, in the eccentricity of its orbit, in the period of its annual revolution, and in the proportion it receives of light and heat. Every comet, too, differs from another in its form and magnitude, in the extent of its nucleus and tail, in the period of its revolution, in the swiftness of its motion, and in the figure of the curve it describes around the sun; and "one star differeth from another star in glory." But could we transport ourselves to the surfaces of these distant orbs, and survey every part of their constitution and arrangements, we should, doubtless, behold beauties and varieties of Divine workman-

vinegar. The most remarkable property of these animals is, that they are *viviparous*. If one of them is cut through near the middle, several oval bodies of different sizes issue forth, which are young *anguillae*, each coiled up in its proper membrane. A hundred and upwards of the young ones have been seen to issue from the body of one single eel, which accounts for their prodigious increase.

It may not be improper to remark, that no engraving can give an adequate idea of the objects referred to above; and, therefore, whoever wishes to inspect nature in all her minute beauties and varieties must have recourse to the microscope itself.

ship far more numerous, and surpassing every thing that appears in our sublunary system. We have every reason to believe, from the infinite nature of the Divinity, and from what we actually behold, that the mechanism and arrangements of every world in the universe are all different from each other; and we find that this is actually the case, in so far as our observations extend. The moon is the principal orb on whose surface particular observations can be made; and we find that its arrangements are materially different from those of the earth. It has no large rivers, seas, or oceans, nor clouds such as ours to diversify its atmosphere. It has mountains and plains, hills and vales, insulated rocks and caverns of every size and shape; but the form and arrangement of all these objects are altogether different from what obtains in our terrestrial sphere.—While, on our globe, the ranges of mountains run nearly in a line from east to west, or from north to south,—on the surface of the moon they are formed for the most part into *circular* ridges, enclosing, like ramparts, plains of all dimensions, from half a mile to forty miles in diameter. While, on earth, the large plains are nearly level, and diversified merely with gentle wavings,—in the moon, there are hundreds of plains of various dimensions, *sunk*, as it were, nearly two miles *below the general level of its surface*. On this orb we behold insulated mountains, more than two miles in elevation, standing alone, like monuments, in the midst of plains,—circular basins or caverns, both in the valleys and on the summits and declivities of mountains, and these caverns, again, indented with smaller ones of a similar form; at the same time, there are plains far more level and extensive than on the earth. On the whole, the mountain-scenery on the lunar surface is far more diversified and magnificent than on our globe, and differs as much from terrestrial landscapes as the wastes and wilds of America from the cultivated plains of Europe. In short, while on the earth the highest mountains are little more than four miles in height, on some of the planets mountains have been discovered, which astronomers have reckoned to be twenty-two miles in elevation.

If, then, it is reasonable to believe, that all the worlds in the universe are different in their construction and arrangements, and peopled with beings of diversified ranks and orders—could we survey *only* a small portion of the universal system—what an amazing scene would it display of the conceptions of the Divine Mind and of "*the manifold Wisdom of God!*" Such views, therefore, of the *variety of nature* are evidently calculated to expand our conceptions of the Divine character, to excite us to admiration and reverence, to extend our views of the riches of Divine Beneficence, and to enlarge our hopes of the glories and felicities of that future "inheritance which is incorruptible, and which fadeth not away."

5. The contemplation of nature, through the medium of science, is calculated to *expand our conceptions of the power of the Deity, and of the magnificence of his empire.* The power of God is manifested by its effects; and in proportion as our knowledge of these effects is enlarged, will our conceptions of this attribute of the Divinity be expanded. To *create* a single object implies an exertion of Power which surpasses finite comprehension: how much more the creation and arrangement of such a vast multiplicity of objects as those to which we have just now adverted! For, all that immense variety of beings which exists in the animal, vegetable, and mineral kingdoms, and in the invisible regions which the microscope has explored, evinces the Omnipotence of the Deity, no less than his Wisdom and Intelligence. But the *magnitude*, as well as the number and variety, of the objects of creation displays the Almighty Power of the Creator. In this point of view, the discoveries of modern astronomy tend to aid our conceptions of the grandeur of this Perfection, and to extend our views of the range of its operations far beyond what former ages could have imagined. When we take a leisurely survey of the globe on which we dwell, and consider the enormous masses of its continents and islands, the quantity of water in its seas and oceans, the lofty ranges of mountains which rise from its surface, the hundreds of majestic rivers which roll their waters into the ocean, the numerous orders of animated beings with which it is peopled, and the vast quantity of matter enclosed in its bowels from every part of its circumference to its centre, amounting to more than *two hundred and sixty thousand millions of cubical miles*—we cannot but be astonished at the greatness of that Being who first launched it into existence, who "measures its waters in the

hollow of his hand, who weighs its mountains in scales, and its hills in a balance;" and who has supported it in its rapid movements, from age to age. But how must our conceptions of Divine Power be enlarged when we consider, that this earth, which appears so great to the frail beings which inhabit it, is only like a small speck in creation, or like an atom in the immensity of space, when compared with the myriads of worlds of superior magnitude which exist within the boundaries of creation! When we direct our views to the planetary system, we behold three or four globes, which appear only like small studs on the vault of heaven, yet contain a quantity of matter more than two thousand four hundred times greater than that of the earth, besides more than twenty lesser globes, most of them larger than our world,* and several hundreds of *comets*, of various magnitudes, moving in every direction through the depths of space. The *Sun* is a body of such a magnitude as overpowers our feeble conceptions, and fills us with astonishment. Within the wide circumference of this luminary more than a million of worlds as large as ours could be contained. His body fills a cubical space equal to 681,472,000,000,000,000 miles, and his surface more than 40,000,000,000, or forty thousand millions of square miles. At the rate of sixty miles a day, it would require more than a hundred millions of years to pass over every square mile on his surface. His attractive energy extends to several thousands of millions of miles from his surface, retaining in their orbits the most distant planets and comets, and dispensing light and heat, and fructifying influence to more than a hundred worlds.† What an astonishing idea, then, does it give us of the power of Omnipotence, when we consider that the universe is replenished with *innumerable* globes of a similar size and splendour! For every star which the naked eye perceives twinkling on the vault of heaven, and those more distant orbs which the telescope brings to view throughout the depths of immensity, are, doubtless, *suns*, no less in magnitude than that which "enlightens our day," and surrounded by a retinue of revolving worlds. Some of them have been reckoned by astronomers to be even much larger than our sun. The star *Lyra*, for example, is supposed, by Sir W. Herschel, to be 33,275,000 miles in diameter, or thirty-eight times the diameter of the sun; and, if so, its cubical contents will be 36,842,932,671,875,000,000,000 miles, that is, more than *fifty-four thousand times* larger than the sun. The *number* of such bodies exceeds all calculation. Sir W. Herschel perceived, in that portion of the Milky-way which lies near the constellation *Orion*, no less than 50,000 stars large enough to be distinctly numbered pass before his telescope in an hour's time; besides twice as many more which could be seen only now and then by faint glimpses. It has been reckoned that nearly a hundred millions of stars lie within the range of our telescopes. And, if we suppose, as we justly may, that each of these suns has a hundred worlds connected with it, there will be found *ten thousand millions of worlds* in that portion of the universe which comes within the range of human observation, besides those which lie concealed from mortal eyes in the unexplored regions of space, which may as far exceed all that are visible, as the waters in the caverns of the ocean exceed in magnitude a single particle of vapour!

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* The satellites of Jupiter, Saturn, and Herschel are all reckoned to be larger than the earth.

† The planetary system, including the *comets*, contains more than a hundred bodies dependent on the sun

Of such numbers and magnitudes we can form no adequate conception. The mind is bewildered, confounded, and utterly overwhelmed when it attempts to grasp the magnitude of the universe, or to form an idea of the Omnipotent energy which brought it into existence. The *amplitude of the scale* on which the systems of the universe are constructed tends likewise to elevate our conceptions of the grandeur of the Deity. Between every one of the planetary bodies there intervenes a space of many millions of miles in extent. Between the sun and the nearest star there is an interval, extending in every direction, of more than twenty billions of miles; and it is highly probable that a similar space surrounds every other system. And if we take into consideration the *immense forces* that are in operation throughout the universe—that one globe, a thousand times larger than the earth, is flying through the regions of immensity at the rate of thirty thousand miles an hour, another at the rate of seventy thousand, and another at a hundred thousand miles an hour, and that millions of mighty worlds are thus traversing the illimitable spaces of the firmament—can we refrain from exclaiming, in the language of inspiration, "Great and marvellous are thy works, Lord God Almighty! Who can by searching find out God? Who can find out the Almighty to perfection? Who can utter the mighty operations of Jehovah? Who can show forth all his praise?"

Such a scene displays, beyond any other view we can take of creation, the *magnificence and extent of the Divine empire.* Those countless worlds to which we have now adverted are not to be considered as scenes of sterility and desolation, or as merely diffusing a useless splendour over the wilds of immensity, nor are they to be viewed as so many splendid toys to amuse a few astronomers in our diminutive world. Such an idea would be altogether inconsistent with every notion we ought to form of the wisdom and intelligence of the Deity, and with every arrangement we perceive in the scenes of nature immediately around us, where we behold every portion of matter teeming with inhabitants. These luminous and opaque globes, dispersed throughout the regions of infinite space, must, therefore, be considered as the abodes of sensitive and intellectual existence, where intelligences of various ranks and orders contemplate the glory and enjoy the bounty of their Creator. And what scenes of diversified grandeur must we suppose those innumerable worlds to display! What numerous orders and gradations of intellectual natures must the universe contain, since so much variety is displayed in every department of our sublunary system! What *boundless intelligence* is implied in the *superintendence* of such vast dominions! On such subjects the human mind can form no *definite* conceptions. The most vigorous imagination, in its loftiest flights, drops its wing and sinks into inanity before the splendours of the "King eternal, immortal, and invisible, who dwells in the light unapproachable," when it attempts to form a picture of the magnificence of the universe which he has created. But of this we are certain, that over all this boundless scene of creation, and over all the ranks of beings with which it is replenished, his moral government extends. Every motion of the material system, every movement among the rational and sentient beings it contains, and every thought and perception that passes through the minds of the unnumbered intelligences which people all worlds, are intimately known, and for ever present to his omniscient eye, and all directed to accomplish the designs of his universal providence and the eternal purposes of his will. "He hath prepared his *throne in the heavens*, his kingdom ruleth over all," and "he doth according to his will among the armies of heaven," as well as "among the inhabitants of the earth." "The host of heaven worshippeth him,—all his works, in all places of his dominions, praise him. His kingdom is an everlasting kingdom, and of his government there shall be no end." At the same moment he is displaying the glory of his power and intelligence to worlds far beyond the reach of mortal eyes,—presiding over the councils of nations on earth, and supporting the invisible animalculæ in a drop of water. "In him" all beings, from the archangel to the worm, "live and move," and on him they depend for all that happiness they now possess, or ever will enjoy, while eternal ages are rolling on.

Such views of the omnipotence of the Deity and of the grandeur of his empire are calculated, not only to expand our conceptions of his attributes, but to enliven our hopes in relation to the enjoyments of the future world. For we behold a prospect boundless as immensity, in which the human soul may for ever expatiate, and contemplate new scenes of glory and felicity continually bursting on the view, "world without end."

Such are some of the views of the Deity which the works of nature, when contemplated through the medium of science, are calculated to unfold. They demonstrate the *unity* of God, his *wisdom* and intelligence,—his boundless *benevolence*,—the vast *multiplicity of ideas which have existed in his mind from eternity*,—his *Almighty power*, and the *magnificence* of his empire. These views are in perfect unison with the declarations of the sacred oracles; they illustrate many of the sublime sentiments of the inspired writers; they throw a light on the moral government of God, and elevate our conceptions of the extent of his dominions; they afford a *sensible* representation of the infinity and immensity of the Divine nature, in so far as finite minds are capable of contemplating such perfections; and, when considered in connexion with the scriptural character of Deity and the other truths of revelation, are calculated "to make the man of God perfect and thoroughly furnished unto every good work." As the works of God without the assistance of his Word, are insufficient to give us a *complete* view of his character and the principles of his moral government, so the bare reading of the Scriptures is insufficient to convey to our minds those diversified and expansive conceptions of the Divinity to which we have adverted, unless we comply with the requisitions of the sacred writers, to "meditate on all his works, to *consider* the operations of his hands, to speak of the glory of his kingdom," and to talk of his "*power*," in order that we may be qualified "to make known to the sons of men his mighty operations, and the glorious majesty of his kingdom."

How very different, then, from the views now stated must be the conceptions formed of the Divinity by those whose range of thought is chiefly confined to the objects that lie within a few miles of their habitation, and how limited ideas must they entertain of Divine perfection! For the view that any one entertains of the nature and attributes of God, must, in some degree, correspond to the knowledge he has acquired of the visible effects of his power, wisdom, and benevolence; since it is only by the sensible manifestations of Deity, either through the medium of nature or revelation, that we know any thing at all about his nature and perfections. And, therefore, if our views of the *manifestations* of the Divinity be limited and obscure, such will likewise be our views of the Divinity himself. It is owing to the want of attention to such considerations that many worthy Christians are found to entertain very confused and distorted ideas of the character of the Deity, of the requisitions of his Word, and of the arrangements of his universal providence. And is it not an object much to be desired, that the great body of mankind should be more fully enlightened in the knowledge of their Creator? The knowledge of God lies at the foundation of all religion, and of all our prospects in reference to the eternal world, and it must surely be a highly desirable attainment to acquire as glorious and expansive an idea of the object of our adoration, as the finite capacity of our intellects is capable of comprehending. Such views as we have now exhibited of the wisdom, power, and beneficence of the Deity, and of the magnificence and variety of his works, were they communicated to the generality of mankind and duly appreciated, would not only interest their affections and increase their intellectual enjoyment, but would enable them to understand the meaning and references of many sublime passages in the volume of inspiration which they are apt either to overlook or to misinterpret. Such views, likewise, would naturally inspire them with *reverence* and *adoration* of the Divine Majesty, with *gratitude* for his wise and benevolent arrangements,—with *complacency* in his administration as the moral Governor of the world,—with a firm *reliance on his providential care* for every thing requisite to their happiness, and with an earnest desire to yield a cordial *obedience* to his righteous laws. At the same time, they would be qualified to declare to others "the glorious honour of his Majesty, to utter abundantly the memory of his great goodness, and to speak of all his wonderful works."

SECTION VII.

On the Beneficial Effects of Knowledge on Moral Principle and Conduct.

KNOWLEDGE is valuable chiefly in proportion as it is practical and useful. It dispels the darkness which naturally broods over the human understanding, and dissipates a thousand superstitious notions and idle terrors by which it has been frequently held in cruel bondage. It invigorates and expands the intellectual faculties, and directs them to their proper objects. It elevates the mind in the scale of rational existence, by enlarging its views and refining its pleasures. It gratifies the desire of the soul for perpetual activity, and renders its activities subservient to the embellishment of life and the improvement of society. It unveils the beauties and sublimities of nature, with which the heavens and the earth are adorned, and sets before us the "Book of God," in which we may trace the lineaments of his character and the ways of his providence. It aggrandizes our ideas of the omnipotence of Deity, and unfolds to us the riches of his beneficence, and the depths of his wisdom and intelligence. And, in the exercise of our powers on such objects, we experience a thousand delightful emotions and enjoyments to which the unenlightened multitude are entire strangers. All such activities and enjoyments may be reckoned among the practical advantages of knowledge.

But there is no application of knowledge more interesting and important than its practical bearings on moral principle and action. If it were not calculated to produce a beneficial effect on the state of morals and the intercourses of general society, the utility of its general diffusion might, with some show of reason, be called in question. But there cannot be the slightest doubt, that an increase of knowledge would be productive of an increase of moral order, and an improvement in moral conduct. For truth, *in thought and sentiment*, leads to truth *in action*. The man who is in the habit of investigating truth, and who rejoices in it when ascertained, cannot be indifferent to its application to conduct. There must be truth in his actions; they must be the expression, the proof, and the effect of his sentiments and affections, in order that he may approve of them, and be satisfied that they are *virtuous*, or accordant with the relations which subsist among moral agents. There must likewise be a truth or harmony between his actions, so that none of them be incoherent with the rest. They must all be performed on the same principles, with the same designs, and by the same rule. To a man who perceives truth and loves it, every incongruity and every want of consistency between sentiment and action, produces a disagreeable and painful sensation; and, consequently, he who clearly perceives the rule of right, and acts in direct opposition to it, does violence to his nature, and must be subjected to feelings and remorses of conscience far more painful than those of the man whose mind is shrouded in ignorance. It is true, indeed, that proficiency in knowledge and in the practice of true morality, do not always proceed with equal pace. But it is nevertheless true, that every action that is truly virtuous is founded on knowledge, and is the result of scrutiny and choice directed by truth; otherwise, what is termed virtue would be only the effect of necessity, of constraint, or of mechanical habits. We need not, therefore, fear that the dominion of virtue* will be contracted, or her influence diminished, by an enlargement of the kingdom of light and knowledge. They are inseparably connected, their empire is one and the same, and the *true* votaries of the one will also be the true votaries of the other. And, therefore, every one that sincerely loves mankind, and desires their moral improvement, will diffuse light around him as extensively as he can, without the least fear of its ultimate consequences; since he knows for certain, that in all cases whatever wisdom excels folly, and light is better than darkness. The following observations will perhaps tend more particularly to confirm and elucidate these positions:

1. *Ignorance is one principal cause* of the want of virtue, and *of the immoralities which abound in the world.* Were we to take a survey of the moral state of the world, as delineated in the history of nations, or as depicted by modern voyagers and travellers, we should find abundant illustration of the truth of this remark. We should find, in almost every instance, that ignorance of the character of the true God, and false conceptions of the nature of the worship and service he requires, have led, not only to the most obscene practices and immoral abominations, but to the perpetration of the most horrid cruelties. We have only to turn our eyes to Hindostan, to Tartary, Dahomy, Benin, Ashantee, and other petty states in Africa; to New-Zealand, the Marquesas, the Sandwich Islands, and to the Society Isles in the Southern Pacific, prior to their late moral transformation, in order to be convinced of this melancholy truth. The destruction of new-born infants,—the burning of living women upon the dead bodies of their husbands,—the drowning of aged parents,—the offering of human victims in sacrifice,—the torturing to death of prisoners taken in battle,—the murder of infants, and the obscene abominations of the societies of *Arreoy* in *Otaheite* and other islands, and the dreadful effects of ambition, treachery, and revenge which so frequently accompany such practices, are only a few specimens of the

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* By *virtue*, in this place, and wherever the term occurs, I understand, conduct regulated by the law of God, including both the external action and the *principle* whence it flows; in other words, Christian morality, or that *holiness* which the Scriptures enjoin.

consequences of ignorance combined with human depravity. It is likewise to ignorance chiefly that the vices of the ancient pagan world are to be attributed. To this cause the apostle of the gentiles ascribes the immoralities of the heathen nations. "The gentiles," says Paul, "having the understanding darkened through the ignorance that is in them, have given themselves over unto lasciviousness, to work all manner of uncleanness with greediness."* And, in another part of his writings, he declares, "Because they did not like to retain God in their knowledge, they were given up to a reprobate mind," or a mind *void of judgment;* and the consequence was, "they were filled with all unrighteousness, fornication, wickedness, covetousness, maliciousness, envy, murder, deceit, and malignity;" they were "backbiters, haters of God, proud, boasters, inventors of evil things, disobedient to parents, without understanding, without natural affection, implacable, and unmerciful."† And if we turn our eyes to the state of society around us, we shall find that the same cause has produced the same effects. Among what class do we find sobriety, temperance, rectitude of conduct, honesty, active beneficence, and abstinence from the grosser vices most frequently to prevail? Is it among ignorant and grovelling minds? Is it not among the wise and intelligent, those who have been properly instructed in their duty, and in the principles of moral action? And who are those that are found most frequently engaged in fighting, brawling, and debauchery, in the commission of theft and other petty crimes, and in rioting in low houses of dissipation? Are they not, for the most part, the rude, the ignorant, and untutored,—those whose instruction has been neglected by their parents or guardians, or whose wayward tempers have led them to turn a deaf ear to the reproofs of wisdom? From all the investigations which of late have been made into the state of immorality and crime, it is found, that gross ignorance, and its necessary concomitant, grovelling affections, are the general characteristics of those who are engaged in criminal pursuits, and most deeply sunk in vicious indulgence. Now, if it be a fact that ignorance is one principal source of immorality and crime, it appears a natural and necessary inference, that the general diffusion of knowledge would tend to counteract its influence and operations. For when we remove the *cause* of any evil, we, of course, prevent the *effects*; and not only so, but at the same time bring into operation all those virtues which knowledge has a tendency to produce.

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* Ephes. iv. 18, 19.

† Rom. i. 28–31.

2. Knowledge is requisite for ascertaining the true principles of moral action, and the duties we ought to perform. Numerous are the treatises which have been written, and various the opinions which have been entertained, both in ancient and modern times, respecting the foundation of virtue and the rules of human conduct. And were we to investigate the different theories which have been formed on this subject, to weigh the arguments which have been brought forward in support of each hypothesis, and to balance the various conflicting opinions which different philosophers have maintained, a considerable portion of human life would be wasted before we arrived at any satisfactory conclusions. But if we take the system of revelation for our guide in the science of morals, we shall be enabled to arrive, by a short process, at the most important and satisfactory results. We shall find, that, after all the theories which have been proposed, and the systems which have been reared by ethical philosophers, the Supreme Lawgiver has comprised the essence of true morality under two commands, or fundamental principles, "Thou shalt love the Lord thy God with all thy heart," and "Thou shalt love thy neighbour as thyself." On these two commandments rests the whole duty of man.

Now, although the leading ideas contained in these commands are simple and obvious to every one who considers them attentively, yet it requires certain habits of reflection and a considerable portion of knowledge to be enabled to trace these laws or principles to all their legitimate consequences, and to follow them in all their ramifications, and in their bearings on human conduct, and on the actions of all moral intelligences. For it can easily be shown, that these laws are so comprehensive as to reach every possible moral action, to prevent every moral evil, and to secure the happiness of every moral agent,—that all the duties inculcated in the Bible, which we owe to God, to our fellow-creatures, and to ourselves, are comprehended in them, and are only so many ramifications of these general and fundamental principles,—that they are equally adapted to men on earth and to angels in heaven,—that their control extends to the inhabitants of all worlds,—that they form the basis of the order and happiness of the whole intelligent system,—and that their authority and influence will extend, not only through all the revolutions of time, but through all the ages of eternity. Here, then, we have a subject calculated to exercise the highest powers of intelligence; and the more we investigate it the more shall we admire the comprehensive nature of that "law which is exceeding broad," and the more shall we be disposed to comply with its divine requisitions. But unless we be, in some measure, acquainted with the first principles of moral action, and their numerous bearings upon life and conduct, we cannot expect to make rapid advances in the path of virtue, or to reach the sublimer heights of moral improvement.

3. Knowledge, combined with habits of thinking, would lead to inquiries into the *reasons* of those moral laws which the Creator has promulgated, and the *foundations* on which they rest. It is an opinion which very generally prevails, even among the more respectable portion of mankind, that the moral laws given forth to men are the *mere dictates of Sovereignty*, and depend solely on the *will* of the Deity, and, consequently, that they might be modified, or even entirely superseded, were it the pleasure of the Supreme Legislator to alter them or to suspend their authority. But this is a most absurd and dangerous position. It would take away from the *inherent excellence* of virtue, and would represent the Divine Being as acting on principles similar to those of an Eastern despot. If such a position were true, it would follow, that all the immoralities, cruelties, oppressions, wars, and butcheries that have taken place in the world, are equally excellent and amiable as truth, justice, virtue, and benevolence, and that the character of infernal fiends is just as lovely and praiseworthy as that of angels and archangels, *provided the Deity willed that such a change should take place.* Were such a change possible, it would not only overturn all the notions we are accustomed to entertain respecting the moral attributes of God, but might ultimately destroy our hopes of future enjoyment, and endanger the happiness of the whole moral universe. But there is an inherent excellence in moral virtue, and the Deity has willed it to exist,

because it is essential to the happiness and order of the intelligent system. It might be shown, that not only the two fundamental principles of religion and morality stated above, but all the moral precepts which flow from them, are founded on the nature of God, and on the relations which subsist among intelligent agents, and that, were they reversed, or their influence suspended, misery would reign uncontrolled through the universe, and in the course of ages the whole moral and intelligent system would be annihilated.*

Now, if men were accustomed to investigate the foundations of morality, and the reasons of those moral precepts which are laid before them as the rule of their conduct, they would perceive a most powerful motive to universal obedience. They would plainly see, that all the laws of God are calculated to secure the happiness of every moral agent who yields obedience to them,—that it is their *interest* to yield a voluntary submission to these laws,—and that *misery*, both here and hereafter, is the certain and *necessary* consequence of their violation. It is a common feeling with a considerable portion of mankind, though seldom expressed in words, that the laws of heaven are too strict and unbending,—that they interfere with what they consider their pleasures and enjoyments, and that if one or more of them could be a little modified or relaxed, they would have no objections to attempt a compliance with the rest. But such feelings and sentiments are altogether preposterous and absurd. It would be inconsistent, not only with the rectitude, but with the *benevolence*, of the Deity, to set aside or to relax a single requisition of that law which is "*perfect*," and which, as it now stands, is calculated to promote the happiness of all worlds. Were he to do so, and to permit moral agents to act accordingly, it would be nothing less than to shut up the path to happiness, and to open the flood-gates of misery upon the intelligent universe. Hence we are told by Him who came to fulfil the law, that, sooner may "heaven and earth pass away," or the whole frame of nature be dissolved, than that "one jot or one tittle can pass from this law." For, as it is founded on the nature of God, and on the relations which subsist between Him and created beings, it must be absolutely perfect, and of eternal obligation; and, consequently, nothing could be taken from it without destroying its perfection, nor any thing added to it without supposing that it was originally imperfect. Were the bulk of mankind, therefore, capable of entering into the spirit of such investigations, and qualified to perceive the true foundations of moral actions; were they, for example, clearly to perceive that *truth* is the bond of society, and the foundation of all delightful intercourse among intelligent beings in every world, and that, were the law which enjoins it to be reversed, and rational creatures to act accordingly, all confidence would be completely destroyed,—the inhabitants of all worlds thrown into a state of universal anarchy, and creation transformed into a chaos,—such views and sentiments could not fail of producing a powerful and beneficial influence on the state of morals, and a profound reverence and respect for that law "which is holy, just, and good."

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* For a full illustration of these positions, and a variety of topics connected with them, the author begs to refer his readers to a work which he lately published, entitled "*The Philosophy of Religion, or an Illustration of the Moral Laws of the Universe.*"

4. Knowledge, in combination with habits of reflection, *would lead to self-examination and self-inspection.* The indolent and untutored mind shuns all exertion of its intellectual faculties, and all serious reflection on what passes within it, or has a relation to moral character and conduct. It is incapable of investigating its own powers, of determining the manner in which they should operate, or of ascertaining the secret springs of its actions. Yet, without a habit of reflection and self-examination, we cannot attain a knowledge of ourselves, and, without self-knowledge, we cannot apply aright our powers and capacities, correct our failings and defects, or advance to higher degrees of improvement in knowledge and virtue. In order to ascertain our state, our character, and our duty, such inquiries as the following must frequently and seriously be the subject of consideration. What rank do I hold in the scale of being, and what place do I occupy in the empire of God? Am I merely a sensitive creature, or am I also endowed with moral and intellectual powers? In what relation do I stand to my fellow-creatures, and what duties do I owe them? What is my ultimate destination? Is it merely to pass a few years in eating and drinking, in motion and rest, like the lower animals, or am I designed for another and a higher sphere

of existence? In what relation do I stand to my Creator, and what homage, submission, and obedience ought I to yield to him? What are the talents and capacities with which I am endowed, and how shall I apply them to the purposes for which they were given me? What are the weaknesses and deficiencies to which I am subject, and how are they to be remedied? What are the vices and follies to which I am inclined, and by what means may they be counteracted? What are the temptations to which I am exposed, and how shall they be withstood? What are the secret springs of my actions, and by what laws and motives are they regulated? What are the tempers and dispositions which I most frequently indulge, and are they accordant with the rules of rectitude and virtue? What are the prejudices I am apt to entertain, and by what means may they be subdued? What are the affections and appetites in which I indulge, and are they regulated by the dictates of reason and the law of God? What are my great and governing views in life? Are they correspondent to the will of my Creator, and to the eternal destination that awaits me? Wherein do I place my highest happiness? In the pleasures of sense, or in the pleasures of intellect and religion,—in the creature or in the Creator? How have I hitherto employed my moral powers and capacities? How do I stand affected towards my brethren of mankind? Do I hate, or envy, or despise any of them? Do I grudge them prosperity, wish them evil, or purposely injure and affront them? Or do I love them as brethren of the same family, do them all the good in my power, acknowledge their excellences, and rejoice in their happiness and prosperity?

Such inquiries and self-examinations, when seriously conducted, would necessarily lead to the most beneficial moral results. In leading us to a knowledge of our errors and defects, they would teach us the excellence of *humility*, the reasonableness of this virtue, and the foundation on which it rests, and of course, the folly of pride, and of all those haughty and supercilious tempers which are productive of so much mischief and unhappiness, both in the higher and the lower spheres of life. Pride is uniformly the offspring of self-ignorance. For, if a man will but turn his eyes within, and thoroughly scrutinize himself, so as to perceive his errors and follies, and the germs of vice which ledge in his heart, as well as the low rank he holds in the scale of creation, he would see enough to teach him humbleness of mind, and to render a proud disposition odious and detestable, and inconsistent with the relations in which he stands to his Creator, to his fellow-creatures, and to the universe at large. Such mental investigations would also lead to self-possession under affronts and injuries, and amid the hurry and disorder of the passions,—to charity, candour, meekness, and moderation, in regard to the sentiments and conduct of others, to the exercise of self-denial, to decorum and consistency of character, to a wise and steady conduct in life, and to an intelligent performance of the offices of piety and the duties of religion. But how can we ever expect that an ignorant uncultivated mind, unaccustomed to a regular train of rational thought, can enter, with spirit and intelligence, on the process of self-examination? It requires a certain portion, at least, of information, and a habit of reflection, before a man can be qualified to engage in such an exercise; and these qualifications can only be attained by the exercise which the mind receives in the acquisition of general knowledge.—If, then, it be admitted, that self-ignorance is the original spring of all the follies and incongruities we behold in the characters of men, and the cause of all that vanity, censoriousness, malignancy, and vice which abound in the world; and if self-knowledge would tend to counteract such immoral dispositions, we must endeavour to communicate a certain portion of knowledge to mankind, to fit them for the exercise of self-examination and self-inspection, before we can expect that the moral world will be renovated, and "all iniquity, as ashamed, hide its head, and stop its mouth."

5. Knowledge, by expanding the mind, will enable it to take a clear and comprehensive view of the motives, bearings, tendencies, and consequences of moral actions. A man possessed of a truly enlightened mind must have his moral sense, or conscience, much more sensible and tender, and more judiciously directed, than that of a person whose understanding is beclouded with ignorance. When he has to choose between good and evil, or between good and better, or between any two actions he has to perform, he is enabled to bring before his mind many more arguments, and much higher and nobler arguments and motives, to determine

the choice he ought to make. When he is about to perform any particular action, his mental eye is enabled to pierce into the remote consequences which may result from it. He can, in some measure, trace its bearings, not only on his friends and neighbours, and the community to which he belongs, but also on surrounding nations, on the world at large, on future generations, and even on the scenes of a future eternity. For an action, whether good or bad, performed by an individual in a certain station in society, may have a powerful moral influence on tribes and nations far beyond the sphere in which it was performed, and on millions who may people the world in the future ages of time. We know that actions, both of a virtuous and vicious nature, performed several thousands of years ago, and in distant places of the world, have had an influence upon the men of the present generation, which will redound either to the honour or the disgrace of the actors, "in that day when God shall judge the world in righteousness, and reward every man according to his works." We also know, that there are certain actions which to some minds may appear either trivial or indifferent, and to other minds beneficial, which nevertheless involve a principle which, if traced to its remoter consequences, would lead to the destruction of the intelligent creation. Now, it is the man of knowledge and of moral perception alone who can recognise such actions and principles, and trace them to all their natural and legitimate results. He alone can apply, with judgment and accuracy, the general laws of moral action to every particular circumstance, connect the present with the future, and clearly discern the mere semblance of truth and moral rectitude from the reality.

In short, the knowledge of divine Revelation, and a serious study of its doctrines and precepts, must accompany every other species of information, if we wish to behold mankind reformed and moralized. It is in the sacred oracles alone that the will of God, the natural character of man, the remedy of moral evil, the rules of moral conduct, and the means of moral improvement, are clearly and fully unfolded. And the man who either rejects the revelations of Heaven, or refuses to study and investigate the truths and moral requisitions they contain, can never expect to rise to the sublime heights of virtue, and to the moral dignity of his nature. But, were the study of the Scriptures uniformly conjoined with the study of every other branch of useful knowledge, we should, ere long, behold a wonderful transformation upon the face of the moral world. Pride, selfishness, malice, envy, ambition, and revenge would gradually be undermined. The spirit of warfare and contention would be subdued; rioting, drunkenness, and debauchery would be held in abhorrence by all ranks; kindness and affection would unite the whole brotherhood of mankind; peace, harmony, and subordination would be displayed in every department of social life; "our judges would be just, and our exactors righteous; wars would be turned into peace to the ends of the earth, and righteousness and praise spring forth before all the nations." Were moral principle thus diffused among the different classes of society, it could not fail of producing a beneficial influence on the progress of the arts and sciences, and on every thing that might tend to meliorate the condition of our fellow-creatures, and to promote the general improvement of mankind. For, in endeavouring to promote such objects, we meet with as great a difficulty in the *moral* as in the intellectual condition of mankind. The principles of *selfishness*, pride, ambition, and envy, and similar dispositions, create obstacles in the way of scientific and philanthropic improvements, tenfold greater than any which arise from pecuniary resources or physical impediments. But were such principles undermined, and a spirit of good-will and affection pervading the mass of society, the machinery of the moral world would move onward with smoothness and harmony; and mankind, acting in unison, and every one cheerfully contributing to the good of the whole, would accomplish objects, and beneficial transformations on the physical and moral condition of society, far superior to any thing that has hitherto been realized.

To what has been now stated, with regard to the influence of knowledge on moral conduct, it may, perhaps, be objected, that many instances occur of men of genius and learning indulging in dissolute and immoral habits, and that the higher classes of society, who have received a better education than the lower, are nearly as immoral in their conduct. In replying to such an objection we have to consider, in the first place, *what is the nature of the education such persons have received.* Most of the higher class have received a grammar-school education, and, perhaps, attended a few sessions at an academy or a university. There cannot, however, be reckoned above one in ten who pursues his studies with avidity, and enters into the spirit of the instructions communicated at such seminaries; as it is well known to every one acquainted with the general practice of such students in colleges and academies, that a goodly number of them spend their time as much in folly and dissipation, as in serious study. But, although they had acquired a competent acquaintance with the different branches to which their attention was directed, what is the amount of their acquisitions? A knowledge of the Greek and Latin Classics, and of pagan mythology, in the acquisition of which five years are generally spent at the grammar-school, and two at the university—and the elements of logic, ethics, and mathematical philosophy. But such departments of knowledge, *in the way in which they have been generally taught*, have no necessary connexion with religion and moral conduct. On the contrary, by keeping the principles of Christianity carefully out of view, and even insinuating objections against them, some professors of these sciences have promoted the cause of infidelity, and consequently impeded the progress of genuine morality. What aid can be expected to morality from a mere grammar-school education, when the acquisition of words and phrases, and the absurd notions and impure practices connected with Roman and Grecian idolatry, form the prominent objects of attention; and when, as too frequently happens, no instructions in Christianity are communicated, and not even the forms of religion attended to in many of those seminaries? The mere acquisition of languages is not the acquisition of useful knowledge: they are, at best, but the *means* of knowledge; and although we would not discourage any one, who has it in his power, from prosecuting such studies, yet it is from other and more important branches of study that we expect assistance in the cause of moral improvement.

With regard to men of learning and genius, we have likewise to inquire into the nature and tendency of their literary pursuits, before we can ascertain that they are calculated to prevent the influence of immoral propensities and passions. Persons are designated men of learning, who have made proficiency in the knowledge of the Greek, Latin, French, German and other languages,—who are skilled in mythology, antiquities, criticism, and metaphysics, or who are profound students in geometry, algebra, fluxions, and other branches of the mathematics. But it is easy to perceive, that a man may be a profound linguist, grammarian, politician, or antiquarian, and yet not distinguished for virtuous conduct; for such departments of learning have no direct bearing upon moral principle or conduct. On the contrary, *when prosecuted exclusively*, *to the neglect of the more substantial parts of knowledge*, and *under the influence of certain opinions and prejudices*, they have a tendency to withdraw the attention from the great objects of religion, and consequently from the most powerful motives which excite to moral action.—We have likewise to inquire whether such persons have made the Christian revelation one great object of their study and attention, and whether they are frequently employed in serious contemplations of the perfections of the Creator, as displayed in the economy of the universe. If such studies be altogether overlooked, we need not wonder that such characters should frequently slide into the paths of infidelity and dissipation; since they neglect an attention to those departments of knowledge which alone can guide them in the paths of rectitude. We may as soon expect to gather "grapes from thorns, or figs from thistles," as to expect pure morality from those, however high they may stand in literary acquirements, who either neglect or oppose the great truths of religion.—We do not mean, however, to insinuate, that the subjects alluded to above are either trivial or unworthy of being prosecuted. On the contrary, we are fully persuaded, that there is not a subject which has ever come under human investigation, when prosecuted with proper views, and in connexion with other parts of knowledge, but may be rendered subservient, in some way or another, both to the intellectual and the moral improvement of man. But when we speak of diffusing useful knowledge among the mass of mankind, we do not so much allude to the capacity of being able to translate from one language into another, of knowing the sentiments of the ancient Greeks and Romans, and the characters and squabbles of their gods and goddesses, or to the faculty of distinguishing ancient coins, fragments of vases, or pieces of armour—as to the facts of history, science, and revelation, particularly in their bearing upon the religious views and the moral conduct of mankind. And if the attention of the great body of the people were directed to such subjects, from proper principles and motives, and were they exhibited to their view in a lucid and interesting manner, there cannot be the smallest doubt, that the interests of virtue and of pure and undefiled religion would be thereby promoted to an extent far beyond what has ever yet been realized.

SECTION VIII.

On the Utility of Knowledge in relation to a Future World.

MAN is a being destined for eternity. The present world through which he is travelling is only a transitory scene, introductory to a future and an immortal existence. When his corporeal frame sinks into the grave, and is resolved into its primitive elements, the intellectual principle by which it was animated shall pass into another region, and be happy or miserable, according to the governing principles by which it was actuated in the present life. The world in which we now reside may be considered as the great nursery of our future and eternal existence, as a state of probation in which we are educating for an immortal life, and as preparatory to our entering on higher scenes of contemplation and enjoyment. In this point of view, it is of importance to consider, that our present views and recollections will be carried along with us into that future world, that our virtues or vices will be as *immortal* as ourselves, and influence our *future* as well as our present happiness, and, consequently, that every study in which we engage, every disposition we now cultivate, and every action we perform is to be regarded as pointing beyond the present to an unseen and eternal existence.

If, then, we admit that the present state is connected with the future, and that the hour of death is not the termination of our existence, it must be a matter of the utmost importance that the mind of every candidate for immortality be tutored in those departments of knowledge which have a relation to the future world, and which will tend to qualify him for engaging in the employments, and for relishing the pleasures and enjoyments of that state. The following remarks are intended to illustrate this position:

We may remark, in the first place, in general, that *the knowledge acquired in the present state*, whatever be its nature, *will be carried along with us when we wing our flight to the eternal world.* In passing into that world we shall not lose any of the mental faculties we now possess, nor shall we lose our *identity*, or consciousness of being the same persons we now feel ourselves to be; otherwise, we behooved to be a different order of creatures, and consequently could not be the subjects either of reward or of punishment for any thing done in the present state. A destruction of our faculties, or a total change of them, or the loss of consciousness, would be equivalent to an annihilation of our existence. But if we carry into the future state all our moral and intellectual powers, we must also, of necessity, carry along with them all the recollections of the present life, and all the knowledge, both physical and moral, which these faculties enabled us to acquire. We have an exemplification of this in the parable of our Saviour respecting the rich man and Lazarus, where Abraham is represented as addressing the former in these words—"Son, *remember*, that thou in thy lifetime receivedst thy good things, and likewise Lazarus evil things;" evidently implying, that the rich man retained the power of *memory*, that he possessed a consciousness that he was the same thinking being that existed in a former state, and that he had a perfect recollection of the conduct he pursued, and the scenes in which he was placed in this sublunary world. If, then, it be admitted, that we shall be, substantially, the same intellectual beings as at present, though placed in different circumstances, and that the ideas and moral principles we now acquire will pass along with us into futurity, and influence our conduct and happiness in that state,—it cannot be a matter of indifference whether the mind of an immortal being be left to grope amid the mists of ignorance, and to sink into immorality, or be trained up in the knowledge of every thing that has a bearing on its eternal destination. On the contrary, nothing can be of higher value and importance to every human being, considered as immortal, than to be trained to habits of reasoning and reflection, and to acquire that knowledge of his Creator, of himself, of his duty, and of the relations in which he stands to this world and to the next, which will qualify him for the society in which he is hereafter to mingle, and the part he has to act in a higher scene of action and enjoyment. For, as gross ignorance is the source of immoral action, and as immoral principles and habits *unfit the soul* for the pleasures and employments of an immortal state, the man who is allowed to remain amid the natural darkness of his understanding can have little hope of happiness in the future world, since he is destitute of those qualifications which are requisite in order to his relishing its enjoyments.

Scientific knowledge, as well as that which is commonly designated theological, *is to be considered as having a relation to the future world*. Science, as I have already had occasion to notice, is nothing else than an investigation of the Divine perfections and operations as displayed in the economy of the universe; and we have every ground to conclude, both from reason and from revelation, that such investigations will be carried forward, on a more enlarged scale, in the future world, where the intellectual powers, freed from the obstructions which now impede their operation, will become more vigorous and expansive, and a more extensive scene of Divine operation be presented to the view. There are certain *applications* of scientific principles, indeed, which may have a reference solely to the condition of society in the present life, such as, in the construction of cranes, diving-bells, speaking-trumpets, steam-carriages, and fire-engines; but the general principles on which such machines are constructed may be applicable to thousands of objects and operations in other worlds with which we are at present unacquainted. The views, however, which science has opened of the wisdom and benevolence of the Deity, of the multiplicity of ideas and conceptions which have existed in his infinite mind, of his almighty power, and of the boundless range of his operations—will not be lost when we enter into the eternal world. They will prepare the soul for higher scenes of contemplation, for acquiring more expansive views of Divine perfection, and for taking more extensive and sublime excursions through the boundless empire of Omnipotence. The same may be affirmed of the principles of arithmetic, algebra, geometry, conic sections, and other departments of the mathematics, which contain truths that are eternal and unchangeable, and that are applicable in every mode of existence, and to the circumstances of all worlds. Such knowledge may form the groundwork of all our future improvements in the world beyond the grave, and give to those who have acquired it, in conjunction with the cultivation of moral principle, a superiority over others in the employments and investigations peculiar to that higher sphere of existence; and, consequently, a more favourable and advantageous outset into the new and unknown regions of the invisible state. To suppose that the leading principles of scientific knowledge are of utility only in the present world, is not only contrary to every enlightened idea we can form of the future state, either from reason or revelation, but would remove some of the strongest motives which should induce us to engage in the prosecution of useful knowledge. If science is to be considered as altogether confined in its views and effects to the transitory scene of this mortal state, its attainment becomes a matter of comparatively trivial importance. To a man hastening to the verge of life, there could be no strong inducement to listen to its deductions or to engage in its pursuits. But if the principles of science, when combined with the truths of revelation, extend to higher objects than the construction of machinery and the embellishment of human life,—if they point beyond the present to a future world, if they tend to expand our views of the attributes of the Divinity, and of the grandeur of his kingdom,—and if they prepare the mind for entering into more ample views and profound investigations of his plans and operations, in that state of immortality to which we are destined,—it must be a matter of importance to every human being, that his mind be imbued with such knowledge, as introductory to the employments of that eternal world which lies before him.—But we may remark more particularly,

In the second place, that *the acquisition of general knowledge, and habits of mental activity, would induce persons to serious inquiries into the evidences of a future state.* Although there are few persons, in a Christian country, who deny the existence of a future world, yet we have too much reason to believe that the great majority of the population in every country are *not thoroughly convinced* of this important truth, and that they pass their lives just as if the present were the ultimate scene of their destination. Notwithstanding all the "church-going" which is so common among us, both among the higher and the lower classes, and the numerous sermons which are preached in relation to this subject, it does not appear that the one-half of our population have any fixed and impressive belief of the reality of an eternal world. If it were otherwise, it would be more frequently manifested in their general temper, conversation, and conduct. But we find the great mass of society as keenly engaged in the all-engrossing pursuit of wealth and honours as if the enjoyments of this world were to last for ever. In general conversation in the social circle, the topic of a future world, and our relation to it, is studiously avoided. While a person may talk with the utmost ease about a projected voyage to America, the East Indies, or Van Diemen's Land, and the geographical peculiarities of these regions, and be listened to with pleasure,—were he to talk, in certain respectable companies, of his departure to another world, and of the important realities to which he will be introduced in that state,—were he even to suggest a hint that the scene of our eternal destination ought occasionally to form the subject of conversation,—either a sarcastic sneer or a solemn gloom would appear on every face, and he would be regarded as a wild enthusiast or a sanctimonious hypocrite. But why should men manifest such a degree of apathy in regard to this topic, and even an aversion to the very idea of it, if they live under solemn impressions of their connexion with an immortal existence? Every one who admits the idea of a future world must also admit that it is one of the most interesting and momentous subjects that can occupy his attention, and that it as far exceeds in importance the concerns of this life, as the ages of eternity exceed the fleeting periods of time. And if so, why should we not appear as eager and interested in conversation on this subject, as we sometimes are in relation to a voyage to some distant land? Yet, among the majority of our fellow-men, there is scarcely any thing to which their attention is less directed, and the very idea of it is almost lost amid the bustle of business, the acquisition of wealth, the dissipations of society, and the vain pageantry of fashionable life.

Among many other causes of the indifference which prevails on this subject, *ignorance* and mental inactivity are none of the least. Immersed in sensual gratifications and pursuits, unacquainted with the pleasures of intellect, and unaccustomed to rational trains of reflection, multitudes pass through life without any serious consideration of the future scene of another world, resolved, at the hour of dissolution, to take their chance with the generations that have gone before them. But were men once aroused to mental activity, and to the exercise of their reasoning powers on important objects, they would be qualified for investigating the evidences which demonstrate the immortality of man, which could not fail to impress their minds with a strong conviction of the dignity of their intellectual natures, and of their high destination. Those evidences are to be found in the Christian revelation which has "brought life and immortality to light," and thrown a radiance on the scenes beyond the grave. But, even independently of revelation, the evidences which prove the immortal destiny of man, from the light of nature, are so strong and powerful, that, when weighed with seriousness and impartiality, they must appear satisfactory to every candid and inquiring mind. When we consider *the universal belief* of the doctrine of man's immortality which has prevailed in all ages and nations—when we consider *the desire of future existence* implanted in the human breast—*the noble intellectual faculties* with which man is endowed, and the strong *desire of knowledge* which forms a part of his constitution—the *capacity of making perpetual progress* towards intellectual and moral perfection—*the unlimited range of view* which is opened to the human faculties throughout the *immensity of space and duration*—the *moral powers* of action with which man is endowed, and their capacity of perpetual expansion and activity—the apprehensions and *forebodings* of the mind, when under the influence of remorse—the *disordered state of the moral world* when contrasted with the systematic order of the material—the *unequal distribution of rewards and punishments* when viewed in connexion with the justice of God—the *absurdity* of admitting that *the thinking principle in man will ever be annihilated*—and the *blasphemous and* *absurd consequences* which would follow, if the idea of a future state of retribution were rejected; when we attend to these and similar considerations, we perceive an assemblage of arguments which, when taken in combination with each other, carry irresistible evidence to the mind of every unbiased inquirer, that man is destined to an immortal existence—an evidence amounting to a moral demonstration, and no less satisfactory than that on which we rest our belief of the existence of the Eternal Mind.* But the greater part of mankind, in their present untutored state, are incapable of entering into such inquiries and investigations. For want of moral and intellectual instruction, they may be said to "have eyes, but see not, ears, but hear not, neither do they understand," and hence, they pass through the scenes of mortality, almost unconscious of their relation to the eternal world, and altogether unprepared for its exercises and enjoyments.

In the next place, *the acquisition of knowledge, in connexion with the cultivation of moral principles and Christian affections, would tend to prepare the mind for the intercourses and employments of the future world.* From divine revelation we are assured, that in the future state of happiness the righteous shall not only join the company of "the spirits of just men made perfect," but shall also be admitted into "the general assembly of angels." With these pure and superior intelligences, and, doubtless too, with the inhabitants of other worlds, shall the redeemed inhabitants of our globe hold delightful intercourse, and join in their sublime conversation on the most exalted subjects. One of the employments in which they will be incessantly engaged will be, to contemplate the Divine works and administration, and to investigate the wonders of creating power, wisdom, and goodness, as displayed throughout the universe. For such are the representations given in Scripture of the exercises of the heavenly world. Its inhabitants are represented as raising the following song of praise to their Creator,—"Great and marvellous are thy works, Lord God Almighty! Just and true are thy ways, thou King of saints;" which evidently implies that both the wonders of his creation and the plan of his moral government are the subjects of their intense study and investigation. And in another scene exhibited in the book of Revelation, they are represented in the sublime adorations they offer to "Him who liveth for ever and ever," as exclaiming, "Thou art worthy, O Lord, to receive glory, and honour, and power; for thou hast created all things, and for thy pleasure they are and were created;" plainly indicating that the scenes of the material universe, and the Divine perfections as displayed in them, are the objects of their incessant contemplation.

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* For a full illustration of these and other evidences of a future state, along with various topics connected with this subject, the author respectfully refers his readers to a work which he lately published, entitled "*The Philosophy of a Future State.*"

Now in order to our being prepared for such intercourses and employments, two grand qualifications are indispensably requisite. In the first place, the cultivation of moral principle and conduct, or, in other words, the attainment of that *holiness* which the Scriptures enjoin, "without which," we are assured, "no man can see the Lord;" that is, can hold no delightful intercourse with him through the medium of his works and providential dispensations. Without this qualification we are altogether unfit for being introduced into the assembly of angels and other pure intelligences, and for joining with them in their holy services and sublime adorations—as unfit as an ignorant Hottentot, a wild Boshe-man, or the lowest dregs of society would be to take a part in an assembly of learned divines, statesmen, or philosophers. In order to a delightful association with any rank of intelligences there must exist a certain congeniality of disposition and sentiment, without which an intimate intercourse would be productive of happiness to neither party. Persons of proud and revengeful dispositions, and addicted to vicious indulgence, could find no enjoyment in a society where all is humility and affection, harmony and love; nor could pure and holy beings delight in associating with them, without supposing the moral laws of the Creator and the constitution of the intelligent universe entirely subverted. Such characters are as opposite to each other as light and darkness; and, therefore, we may as soon expect to make the east and west points to meet together, or to stop the planets in their career, as to form an harmonious union between the ignorant and vicious, and the enlightened and virtuous inhabitants of the celestial world. In the next place, a knowledge of the character of God, of his moral dispensations, and of his works of creation must form a preparation for the exercises of the heavenly state; since these are some of the subjects which occupy the attention of "the innumerable company of angels and the spirits of just men made perfect." But how could we be supposed to engage in such studies, and to relish such employments, if we remain altogether unacquainted with them till our spirits take their flight from these tabernacles of clay? How could a man whose mind is continually grovelling among the meanest and the most trivial objects, whose soul never rises above the level of his daily labours, which necessity compels him to perform, whose highest gratification is to carouse with his fellows, to rattle a set of dice, or to shuffle a pack of cards, and who is incapable of prosecuting a train of rational thought—how could such a one be supposed qualified for entering, with intelligence and delight, into the sublime investigations and the lofty contemplations which arrest the attention, and form the chief exercises "of the saints in light?" There is an utter incongruity in the idea, that a rude and ignorant mind could relish the enjoyments of the heavenly world, unless it be enlightened and transformed into the image of its Creator; and we have no warrant from revelation to conclude that such a transformation will be effected after the spirit has taken its flight to the invisible state.

But it is easy to conceive what transporting pleasures will be felt by an enlightened and virtuous individual, when he is ushered into a scene where his prospects will be enlarged, his faculties expanded, and the causes which now obstruct their energies for ever removed. He will feel himself in his native element, will resume his former investigations on a more enlarged scale, and with more vigour and activity, and enjoy the prospect of perpetually advancing from one degree of knowledge and felicity to another throughout an interminable succession of existence. Having studied the moral character of God as displayed in his Word and in the dispensations of his providence; having acquired, after all his researches, only a faint and imperfect glimpse of his moral attributes; having met with many difficulties and labyrinths in the movements of the Divine government which he was altogether unable to unravel, which produced an ardent longing after a more enlarged sphere of vision—how gratifying to such a mind must it be to contemplate the Divine character in the fulness of its glory, to behold the apparent inconsistencies of the Divine government reconciled, its intricate mazes unravelled, its wisdom and rectitude displayed, and the veil which concealed from mortals the reasons of its procedure for ever withdrawn! Having taken a cursory survey of the displays of Divine wisdom and goodness in the arrangement of our sublunary system, and in the construction of the animal and vegetable tribes with which it is furnished; having directed his views by the light of science to the celestial regions; having caught a glimpse of the astonishing operations of Almighty Power in the distant spaces of the firmament; having been overwhelmed with wonder and amazement at the extent and grandeur of the Divine empire; having cast many a longing look towards distant worlds, mingled with many anxious inquiries into their nature and destination which he was unable to resolve, and having felt an ardent desire to learn the history of their population, and to behold the scene of the universe a little more unfolded—what transporting joys must be felt by such an individual, when he shall enter into a world where "he shall know even as also he is known;" where the veil which intercepted his view of the wonders of creating power shall be removed; where the cherubim and the seraphim, who have winged their flight through regions of immensity impassable by mortals, shall rehearse the history of other worlds; where the sphere of vision will be enlarged, the faculties invigorated, and the glories of Divine goodness, wisdom, and omnipotence displayed in all their effulgence! Having familiarized such objects to his mind during this first stage of his existence, he will enter on the prosecution of new discoveries of Divine perfection with a renovated holy ardour, of which rude and grovelling minds are incapable, which will fill his soul with ecstatic rapture—even "with joy unspeakable and full of glory."

Let us suppose, for the sake of illustration, two individuals of opposite characters entering the future world at the same time—the one rude, ignorant, and vicious; and the other "renewed in the spirit of his mind," and enlightened with all the knowledge which science and revelation can furnish—it is evident that, although they were both ushered into the same locality, their state and enjoyments would be altogether different. The one would sink, as it were, to his natural level, following the principles, propensities, and passions which he previously indulged; and, although he were admitted into the society of pure and enlightened spirits, he would remain as a cheerless, insulated wretch, without intellectual activity, and destitute of enjoyment. Finding no pleasures suited to his benighted mind and his grovelling affections, he would be fain to flee to other regions and to more congenial associates, as the owl flies from the vocal grove and the society of the feathered choir, and prefers the shades of night to the beams of day. Like this gloomy bird, which delights in obscure retreats and rugged ruins, and has no relish for blooming gardens and flowery meads—the unenlightened and unsanctified soul would feel itself unhappy and *imprisoned*, as it were, even amid triumphant spirits and the splendours of immortal day. Whereas the other, having ardently longed for such a state, and having previously undergone the requisite preparation for its enjoyments, feels himself in a region suited to his taste, mingles with associates congenial to his disposition, engages in exercises to which he was formerly accustomed, and in which he delighted, beholds a prospect, boundless as the universe, rising before him, on which his faculties may be exercised with everlasting improvement and everlasting delight, and, consequently, experiences a "fulness of joy" which can never be interrupted, but will be always increasing "world without end."

Such are the views we must necessarily adopt respecting the state and enjoyments of these two characters in the life to come; and there is no resisting of the conclusion we have deduced respecting the ignorant and vicious individual, without supposing that something equivalent to a miracle will be performed in his behalf, immediately after his entrance into the invisible world, to fit him for the employments of a state of happiness. But for such an opinion we have no evidence either from Scripture or from reason. It would be contrary to every thing we know of the moral government of God; it would strike at the foundation of all religion and morality; it would give encouragement to ignorance and vice; it would render nugatory all the efforts of a virtuous character to increase in knowledge and holiness during the present life, and it would give the ignorant and the licentious an equal reason for expecting eternal happiness in the world to come, as the most profound Christian philosophers, or the most enlightened and pious divines. Besides, we are assured by the "Faithful and True Witness," that, as in the future world, "he who is righteous shall remain righteous still," so "he who is unjust shall remain unjust still, and he who is filthy shall remain filthy still;" which expressions seem evidently to imply, that no more opportunities will be granted for reforming what had been amiss, and recovering the polluted and unrighteous soul to purity and rectitude.*

If, then, it appears, that we shall carry the knowledge and moral habits we acquire in this life along with us into the other world,—and if a certain portion of rational and religious information and moral principle is essentially requisite to prepare us for the employments and felicities of that state—by refusing to patronise every scheme by which a general diffusion of knowledge may be promoted, we not only allow our fellow-men to wander amid the mists of superstition, and to run heedlessly into numerous dangers, both physical and moral, we not only deprive them of exquisite intellectual enjoyments, and prevent the improvement of the arts and sciences, but we deprive them, in a certain degree, of the chance of obtaining happiness in a state of immortality. For as ignorance is the parent of vice, and as vicious propensities and indulgences necessarily lead to misery both here and hereafter, the man whose mind is left to grope amid intellectual darkness can enjoy no well-founded hope of felicity in the life to come, since he is unqualified for the associations, the contemplations, and the employments of that future existence. As in the material creation light was the first substance created before the chaos was reduced to beauty and order, so, in the intellectual world, knowledge, or light in the understanding, is the first thing which restores the moral system to harmony and order. It is the commencement of every process that leads to improvement, comfort, and moral order in this life, and that prepares us for the enjoyments of the life to come. But ignorance is both the emblem and the prelude of "the blackness of darkness for ever." This is one of the most powerful considerations which should induce every philanthropist to exert every nerve, and to further every scheme which has for its object to diffuse liberty, knowledge, and moral principle among all the inhabitants of the earth.

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* Whatever opinion we may form as to the doctrine of *universal restoration*,—it will be admitted, even by the abetters of that doctrine, that an unholy and unenlightened soul is unfit for celestial happiness *on its first entrance into the future world*, and thousands or millions of years, or a period equivalent to what is included in the phrase "ages of ages," may elapse before it is fit for being restored to the dignity of its nature and the joys of heaven. Even on this supposition (although it were warranted by Scripture), the preparation of human beings in the present life for a state of future happiness must be a matter of the highest importance, since it prevents the sufferings denoted by "devouring fire, weeping, wailing, and gnashing of teeth," during the indefinite and long-continued period of "ages of ages."

SECTION IX.

On the Utility of General Knowledge in relation to the Study of Divine Revelation.

Of all the departments of knowledge to which the human mind can be directed, there is none of greater importance than that which exhibits the real character and condition of man as a moral agent—his relation to the Deity—his eternal destiny—the way in which he may be delivered from the effects of moral evil—and the worship and service he owes to his Almighty Creator. On these and kindred topics the Christian revelation affords the most clear and satisfactory information, and the details which it furnishes on these subjects are of the highest moment, and deeply interesting to every inhabitant of the globe. But ignorance, leagued with depravity and folly, has been the cause that the sacred oracles have so frequently been treated with indifference and contempt; and that those who have professed to recognise them as the intimations of the will of the Deity have been prevented from studying them with intelligence, and contemplating the facts they exhibit in all their consequences and relations.

In order to a profitable study of the doctrines, facts, and prophecies contained in the Bible, it is requisite, in the first place, that a deep and thorough conviction be produced in the mind, that they are indeed the revelations of Heaven, addressed to man on earth to direct his views and conduct as an accountable agent, and a candidate for immortality. From ignorance of the *evidences* on which the truth of Christianity rests, multitudes of thoughtless mortals have been induced to reject its authority, and have glided down the stream of licentious pleasure, "sporting themselves with their own deceivings," till they landed in wretchedness and ruin. The religion of the Bible requires only to be examined with care, and studied with humility and reverence, in order to produce a full conviction of its celestial origin; and wherever such dispositions are brought into contact with a calm and intelligent investigation of the evidences of revelation, and of the facts and doctrines it discloses, the mind will not only discern its superiority to every other system of religion, but will perceive the beauty and excellence of its discoveries, and the absolute necessity of their being studied and promulgated in order to raise the human race from that degradation into which they have been so long immersed, and to promote the renovation of the moral world. And those objections and difficulties which previously perplexed and harassed the inquirer will gradually evanish, as the mists of the morning before the orb of day.

The *evidences* of Christianity have been generally distributed into the *external* and the *internal*. The external may again be divided into *direct* and *collateral*. The *direct* evidences are such as arise from the nature, consistency, and probability of the facts; and from the simplicity, uniformity, competency, and fidelity of the testimonies by which they are supported. The *collateral* evidences are those which arise from the concurrent testimonies of heathen writers, or others, which corroborate the history of Christianity, and establish its leading facts. The *internal* evidences arise, either from the conformity of the announcements of revelation to the known character of God, from their aptitude to the frame and circumstances of man, or from those convictions impressed upon the mind by the agency of the Divine Spirit.

In regard to the *external* evidences, the following propositions can be supported both from the testimonies of profane writers, the Scriptures of the New Testament, and other ancient Christian writings: viz. 1. "That there is satisfactory evidence that many professing to be original witnesses of the Christian miracles passed their lives in labours, dangers, and sufferings, voluntarily undergone in attestation of the accounts which they delivered, and solely in consequence of their belief of those accounts; and that they also submitted, from the same motives, to new rules of conduct." And, 2. "That there is *not* satisfactory evidence, that persons pretending to be original witnesses of any other miracles have acted in the same manner, in attestation of the accounts which they delivered, and solely in consequence of their belief of the truth of these accounts." These propositions can be substantiated to the conviction of every serious and unbiased inquirer; they form the basis of the external evidence of the Christian religion; and when their truth is clearly discerned, the mind is irresistibly led to the conclusion, that the doctrines and facts promulgated by the first propagators of Christianity are true.

The following propositions can also be satisfactorily proved: viz. That the Jewish religion is of great antiquity, and that Moses was its founder,—that the books of the Old Testament were extant long before the Christian era; a Greek translation of them having been laid up in the Alexandrian library in the days of Ptolemy Philadelphus,—that these books are in the main genuine, and the histories they contain worthy of credit,—that many material facts which are recorded in the Old Testament are also mentioned by very ancient heathen writers,—that Christianity is not a modern religion, but was professed by great multitudes nearly 1800 years ago,—that Jesus Christ, the founder of this religion, was crucified at Jerusalem during the reign of Tiberius Cæsar,—that the first publishers of this religion wrote books containing an account of the life and doctrines of their Master, several of which bore the names of those books which now make up the *New Testament*,—that these books were frequently quoted and referred to by numerous writers, from the days of the apostles to the fourth century and downwards,—that they are genuine, or written by the authors whose names they bear,—that the histories they contain are in the main agreeable to those facts which were asserted by the first preachers and received by the first converts to Christianity,—that the facts, whether natural or supernatural, which they record, are transmitted to us with as great a degree of evidence (if not greater) as any historical fact recorded by historians of allowed character and reputation,—and that these books were written under a superintendent inspiration. These and a variety of similar propositions intimately connected with them can be fully substantiated; and the necessary conclusion of the whole is, that Christianity is a revelation from God to man, and that its truths are to be believed, and its precepts practised by all to whom they are addressed.

Miracles form one part of the external evidence by which revealed religion is supported. If God, in compassion to our benighted and bewildered race, has thought fit to communicate a revelation of his will, there is no conceivable mode by which that revelation could be more powerfully attested, than by empowering the messengers whom he inspired to work miracles, as attestations of the truth of the doctrines they declared. Accordingly we find, that at the introduction both of the Jewish and the Christian dispensations, a series of uncontrolled miracles was exhibited to those to whom the messengers of revelation were sent, as evidences that they acted under the authority of the Creator of the universe. Under the administration of Moses, who founded the Jewish economy, the waters of Egypt were turned into blood, darkness covered all that country for three days, thunders and hail terrified its inhabitants and destroyed the fruits of their ground, and all their first-born were slain by a celestial messenger in one night; the Red Sea was parted asunder, the tribes of Israel passed in safety through its waves, while their enemies "sank as lead in the mighty waters;" water was brought from the flinty rock, manna from heaven was rained down to supply the wants of two millions of human beings in a barren wilderness; Mount Sinai was made to tremble to its centre, and was surrounded with flames and smoke; Korah, Dathan, and Abiram, with all the thousands that joined their conspiracy, were by a miraculous earthquake swallowed up in a moment; Jordan was divided when its waters overflowed its banks, and at the sound of horns the strong walls of Jericho fell prostrate to the ground. When Jesus Christ introduced the Gospel dispensation, he gave incontrovertible proofs of his divine mission, by curing diseases of every description merely by his word, causing the lame to walk, the deaf to hear, the dumb to speak, and the blind to see; raising the dead to life, stilling the tempestuous waves and the stormy wind; turning water into wine, feeding five thousand men in a wilderness on a few loaves and fishes; and, particularly, by his own resurrection from the dead, after he had been "crucified and slain." These, as well as the miracles wrought by Moses, were demonstrative evidences of the agency and interference of the Most High; they were completely beyond the power of mere human agency, and were altogether different from the tricks of jugglers and impostors. They were performed in the open face of day, in the presence of multitudes of persons of every description; they were level to the comprehension of every man whose faculties and senses were in a sound state; and the conclusion which every unbiased mind behooved to draw from them was, that "no man could do such miracles unless God was with him;" and consequently, that the truths declared by those who were empowered to perform them are the revelations of heaven; for it would be inconsistent with the nature of the Divine Being to suppose, that he would interpose his almighty power to control the laws of nature, for the purpose of giving his sanction to falsehood or imposture.

Of the reality of the miraculous events to which I have alluded, we have as high a degree of evidence as we have for the reality of any other fact recorded in the Scriptures or in the history of the world. The single fact of *the Resurrection of Christ*,—a fact so important in the Christian system, and with which all its other facts and doctrines are essentially connected,—rests upon a weight of evidence so great that the rejection of it would be almost equivalent to the adoption of universal skepticism. This fact does not rest upon the testimony of an unknown individual, or even of an unknown multitude, but on the twelve apostles who had been previously chosen for this purpose, who had accompanied their Master in all his journeys, who had been the witnesses of his miracles, sufferings, and crucifixion, and who affirmed, without the least hesitation, and in the face of every threatening and persecution, that they had seen him alive at different times, and held intimate converse with him, after he had risen from the dead. It rests likewise on the testimony of the seventy disciples, and on that of the five hundred brethren who had seen the Lord after his resurrection. These persons had full opportunity of information as to the fact they asserted; they could not be deceived, for it was brought within the evidence of their senses. They *saw* the body of the Lord Jesus after he had been crucified and laid in the tomb—not with a passing glance, but at different times and in divers places; they had an opportunity of *handling* it to convince them it was no phantom; they *heard* him speak, and entered into intimate conversation with him on the subject of their future ministry. They saw him, not only separately, but together; not only by night, but by day; not at a distance, but immediately before them. And as they could not be deceived themselves, they could have no motive for deceiving others; for they were aware, that by so doing they exposed themselves to scorn, persecution, sufferings, and death itself, without the most distant hope of recompense either in this world or in another. Their character and conduct were strictly watched and scrutinized. Their enemies had taken every precaution which human wisdom could devise, to prevent the dead body of their Master from being removed from the sepulchre, either by fraud or by violence, and to secure the public from being deluded by any attempt at imposture. And yet, only a few days after he was buried, and in the very place where he was crucified, his resurrection was publicly asserted and proclaimed; and no attempt was made on the part of the Jewish rulers to invalidate the testimony of the apostles, by producing the dead body of him whom they had crucified—on whose tomb they had set a seal and a guard of Roman soldiers. For it is evident, that if his body could have been found, they would have produced it as the shortest and most decisive confutation of the story of the resurrection. All these circumstances being considered, to suppose that the apostles either were deceived, or attempted to deceive the world, would be to admit a miracle as great as that of the resurrection itself. But if the fact of Christ's resurrection be admitted, the truth of the evangelical history and of the doctrines of Christianity follows as a necessary consequence.

Prophecy forms another branch of the external evidences of religion. As God alone can perceive with certainty the future actions of free agents, and the remote consequences of those laws of nature which he himself established—prophecy, when clearly fulfilled, affords the most convincing evidence of an intimate and supernatural communion between God and the person who uttered the prediction. It is evident, however, that prophecy was never intended as an evidence of an original revelation. From its very nature it is totally unfit for such a purpose, because it is impossible, without some extrinsic proof of its divine origin, to ascertain whether any prophecy be true or false, till the period arrive when it ought to be accomplished. But when it is fulfilled, it affords complete evidence that he who uttered it spake by the Spirit of God, and that the doctrines he taught were dictated by the same Spirit, and consequently true. To us, therefore, who live in an age posterior to the fulfilment of many of the ancient prophecies, and while some of them are actually accomplishing, the fulfilment of these predictions forms a powerful and striking evidence of the divine authority of the writers both of the Old and the New Testament.

The first prophecy which was given forth in the garden of Eden, that "the seed of the woman should bruise the head of the serpent," and the predictions of the Jewish prophets respecting the appearance, the miracles, the sufferings, the death, resurrection, and subsequent glory of Messiah, and the opposition he was to endure from the people to whom he was sent, were literally accomplished, when Jesus Christ appeared in the world; and the narrations of the evangelists may be considered as a commentary upon these ancient prophecies. The deliverance of the Jews from the Babylonish captivity, and its accomplishment by Cyrus,—the conquest of Egypt by Nebuchadnezzar, foretold by Jeremiah,—the succession of the Assyrian, Persian, Grecian, and Roman monarchies,—the persecution of the Jews under Antiochus Epiphanes, and the erection of the papal kingdom foretold by Daniel,—and the destruction of Jerusalem and the dreadful miseries which should befall its inhabitants, foretold by Jesus Christ, have all received their accomplishment, according to the spirit and import of the original predictions, and this accomplishment is imbodied in the history of nations.

But there are prophecies which were uttered several thousands of years ago, of the accomplishment of which we have *sensible evidence* at the present moment, if we look around us and consider the state of the nations and empires of the world. For example, it was prophesied respecting Ishmael, the son of Abraham, "that he should be a wild man; that his hand should be against every man, and every man's hand against him; that he should dwell in the presence of all his brethren; that he should be multiplied exceedingly, beget twelve princes, and become a great nation." This prediction has been literally accomplished in the *Arabs*, the undoubted descendants of Ishmael, who, for time immemorial, have been robbers by land and pirates by sea; and though their hands have been against every man, and every man's hand against them, they have always dwelt, and at this day still dwell, in "the presence of their brethren," a free and independent people. The greatest conquerors in the world have attempted to subdue them, but their attempts uniformly failed of success. When they appeared on the brink of ruin, they were signally and providentially delivered. Alexander was preparing an expedition against them, when he was cut off in the flower of his age. Pompey was in the career of his conquest, when urgent affairs called him to another quarter. Gallius had penetrated far into their country, when a fatal disease destroyed great numbers of his men, and obliged him to return. Trajan besieged their capital city; but was defeated by thunder, and lightning, and whirlwinds. Severus besieged the same city twice, and was twice repelled from before it. Even the Turks have been unable to subdue the Arabs, or even to restrain their depredations; and they are obliged to pay them a sort of annual tribute for the safe passage of the pilgrims who go to Mecca to pay their devotions. The curse pronounced upon *Ham*, the father of Canaan, could also be shown to have been signally accomplished in the case of the Canaanites, and the Africans, their descendants, who have been literally "a servant of servants to their brethren." They were under the dominion, first of the Romans, then of the Saracens, and now of the Turks. And in what ignorance, barbarity, *slavery*, and misery do most of them remain? Many thousands of them are every year bought and sold, like beasts in the market, and conveyed from one quarter of the world to do the work of beasts in another. The present state of *Babylon* is also a striking accomplishment of the denunciations of ancient prophecy. When we consider the vast extent and magnificence of that ancient city, "the glory of kingdoms and the beauty of the Chaldee's excellency," we should have thought it almost *impossible* that it should have become "an utter desolation," that "the wild beasts should cry in its desolate houses, and dragons in its pleasant palaces," and that "it should never be inhabited nor dwelt in from generation to generation," as the prophet Isaiah had foretold, several hundreds of years prior to its destruction, and when it was flourishing in the height of its glory.* Yet we know for certain, that this once magnificent metropolis, whose hanging gardens were reckoned one of the seven wonders of the world, has become so complete a desolation, that the besom of destruction has left scarcely a single trace of its former grandeur; and it is a subject of dispute among travellers, whether the exact site on which it was built be yet ascertained.

In short, the present state of the Jews, compared with ancient predictions, is one of the most striking and convincing proofs of the literal fulfilment of the Old Testament prophecies. The following prediction respecting them was uttered more than 1700 years before the commencement of the Christian era: "The Lord shall scatter thee among all people, from the one end of the earth even unto the other. And among those nations shalt thou find no ease, neither shall the sole of thy foot have rest; but the Lord shall give thee a trembling heart, and failing of eyes, and sorrow of mind."—"And thou shalt become an astonishment, a proverb, and a by-word among all the nations whither the Lord shall lead you."† The whole history of the Jewish nation since the destruction of Jerusalem, as well as the present state of that singular people, forms a striking commentary upon these ancient predictions, and shows that they have been fully and literally accomplished. The Jews, it is well known, have been dispersed almost over the whole face of the globe for more than seventeen hundred years; they have been despised and hated by all nations; they have suffered the most cruel persecutions; "their life has hung in doubt before them, and they have feared day and night," both for their property and their lives; they have been sold in multitudes, like cattle in the market; they have been exposed on public theatres, to exhibit fights, or be devoured by wild beasts. So strong were popular prejudices and suspicions against them, that in the year 1348, on *suspicion* of their having poisoned the springs and wells, a million and a half of them were cruelly massacred. In 1492, 500,000 of them were driven out of Spain, and 150,000 from Portugal, and even at the present moment they are, in most places, subjected both to civil incapacities and unchristian severities. Yet, notwithstanding the hatred and contempt in which they are held, wherever they appear, they are most obstinately tenacious of the religion of their fathers, although their ancestors were so prone to apostatize from it; and although most of them seem to be utter strangers to piety, and pour contempt on the *moral* precepts of their own law, they are most obstinately attached to the *ceremonial* institutions of it, burdensome and inconvenient as they are. They have never been amalgamated with any of the nations among which they dwelt; they remain a distinct people, notwithstanding their numerous dispersions; their numbers are not diminished; and, were they collected into one body, they would form a nation as numerous and powerful as in the most flourishing periods of the Jewish commonwealth. The existence of the Jews in such circumstances, *as a distinct nation*, so contrary to the history of every other nation, and to the course of human affairs in similar cases, may justly be considered as *a standing miracle* for the truth of Divine revelation. Such a scene in the conduct of the Divine government cannot be paralleled in the history of any other people on the face of the earth; and their being permitted so long to survive the dissolution of their own state, and to continue a distinct nation, is doubtless intended for the accomplishment of another important prediction, viz. that "they may return and seek the Lord their God, and David their king, and fear the Lord and his goodness in the latter days." In the present day, we perceive a tendency towards this wished-for consummation. Within these last thirty years, a greater number of Jews has been converted to the profession of the Christian faith than had happened for a thousand years before. And when they shall be collected from all the regions in which they are now scattered, and brought to the acknowledgment of Jesus Christ as the true Messiah, and to submission to his laws, and reinstated either in their own land or in some other portion of the globe, such an event will form a sensible demonstration of the divinity of our religion, level to the comprehension of all nations, and which all the sneers and sophisms of skeptics and infidels will never be able to withstand.

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* Isaiah xiii. 19–22.

† Deut. ch. xxviii.

The *internal* evidences of Christianity are those which are deduced from the nature of the facts, doctrines, and moral precepts which it reveals, and from the harmony and consistency of all its parts. The following is a brief summary of the leading views which may be taken of this subject.

1. *The dignity and majesty of the style* in which many portions of the Scriptures are written, and *the sublimity of many of the ideas and sentiments* they contain, are strong presumptions of their divine original. This is strikingly exhibited in all those cases in which the perfections and operations of the Deity are brought into view, as in such passages as the following,—"He hangeth the earth upon nothing; he bindeth up the waters in his thick clouds; he hath compassed the waters with bounds, until the day and night come to an end; the pillars of heaven tremble and are astonished at his reproof. He divideth the sea by his great power; by his spirit he hath garnished the heavens. Lo, these are only parts of his ways, but how little a portion is heard of him, and the thunder of his power who can comprehend?"—"By the word of the Lord were the heavens made; he spake and it was done, he commanded and it stood fast."—"Great is Jehovah and of great power: his greatness is unsearchable, his understanding is infinite; marvellous things doth he which we cannot comprehend." "The heaven, even the heaven of heavens cannot contain him; he hath prepared his throne in the heavens, and his kingdom ruleth over all. He doth according to his will in the army of heaven and among the inhabitants of the earth, and none can stay his hand, or say unto him, what dost

thou?"—"Who hath measured the ocean in the hollow of his hand, and meted out heaven with the span, and comprehended the dust of the earth in a measure, and weighed the mountains in scales and the hills in a balance. Who hath directed the Spirit of the Lord, or, being his counsellor, hath taught him? Behold, the nations are as a drop of a bucket, and are counted as the small dust of the balance. Behold, he taketh up the isles as a very little thing. All nations before him are as nothing, and they are counted to him less than nothing, and vanity." These and many similar passages to be found in the sacred writings, far surpass, in dignity of language and sublimity of sentiment, every thing that is to be found in the writings of the most celebrated poets and philosophers of Greece and Rome. If we take the most animated poems of Homer, Virgil, or Horace, and read them in a prose translation, as we do the Scriptures, they appear flat and jejune, and their spirit is almost evaporated; and the words they put into the mouths of their deities, and the actions they ascribe to them, are frequently both ridiculous and absurd, calculated to excite hatred and contempt, instead of adoration and reverence. But the Scriptures preserve their sublimity and glory even in the most literal translation, and such a translation into any language is always found to be the best; and it has uniformly happened, that those who have presumed to heighten the expressions by a poetical translation or paraphrase have failed in the attempt. It indicates an utter want of true taste in any man to despise or undervalue these writings. Were it not that the sacred penmen lay claim to the inspiration of the Almighty, and, consequently, set themselves in direct opposition to pride, lasciviousness, revenge, and every other unholy principle and passion, the Bible, in point of the beauty and sublimity of its sentiments, and the *variety* of interesting information it conveys, would be prized more highly by every man of taste than all the other writings either of poets, philosophers, or historians which have descended to us from the remotest ages of antiquity.

The Christian religion *exhibits the most rational, sublime, and consistent views of the Divine Being*. It represents him as self-existent and independent, and as "the high and lofty One who inhabited eternity," before the universe was brought into existence, in whose sight "a thousand years are as one day, and one day as a thousand years." It represents him as filling the immensity of space with his presence, as having the most intimate knowledge of all creatures and events throughout the vast creation, as the Creator of heaven and earth, as possessed of uncontrollable power, infinite wisdom and intelligence, boundless benevolence and mercy, perfect rectitude and holiness, and inviolable faithfulness and truth. It represents his providential care as extending to all the creatures he has formed, and to all their movements, however numerous or minute; animating the vegetable and animal tribes, setting bounds to the raging billows, "thundering marvellously with his voice, sending lightnings with rain," having "his way in the whirlwind and the storm," making "the earth to quake at his presence," shining in the stars, glowing in the sun, and moving with his hands the mighty worlds which compose the universe. It represents him as governing the universe of minds which he has formed, as having the "hearts" and purposes "of all men in his hand," and as directing all the mysterious and wonderful powers of knowledge and moral action to fulfil his purposes throughout the whole extent of his immense and eternal empire. Such a Being, when properly contemplated, is calculated to draw forth the love and adoration of all rational beings; and wherever Christianity has imparted a knowledge of these attributes of the Divinity, idolatry and superstition, with all their absurdities, abominations, and horrid cruelties, have gradually disappeared.

3. Christianity has given us full assurance of *the immortality of man, and of a future state of punishments and rewards*. Nothing can be of more importance to every human being than to be assured of his eternal destination. Without the discoveries of Christianity, we can attain to no absolute certainty on this momentous subject. The greatest philosophers of the heathen world considered the arguments in favour of man's immortal destiny as amounting only to a certain degree of probability, and their minds were continually hanging in doubt and uncertainty, as to what might befall them at the hour of dissolution. The most powerful arguments in proof of a future retribution are founded on the justice, the benevolence, and the wisdom of the Deity; but it is questionable whether we should ever have acquired

clear conceptions of these attributes of the Divinity without the aid of the revelations of the Bible. On this most important point, however, Christianity dissipates every obscurity, dispels every doubt, and sets the doctrine of "life and immortality" beyond the grave, in the clearest light, not by metaphysical reasonings, unintelligible to the bulk of mankind, but by the positive declarations of him who hath "all power in heaven and on earth." It gives full assurance to all who devote themselves to the service of God, and conform to his will, that "when their earthly tabernacles are dissolved, they have a building of God, an house not made with hands eternal in the heavens;" and that "the afflictions" to which they are now exposed "work out for them an eternal weight of glory." And to console them in the prospect of dropping their bodies into the grave, they are assured, that the period is approaching when their mortal frame "shall put on immortality," and when "all who are in their graves shall hear the voice of the Son of God, and shall come forth, they that have done good to the resurrection of life, and they that have done evil to the resurrection of condemnation."

4. Christianity clearly *points out the way by which pardon of sin may be obtained by the guilty.* Reason discovers that man is guilty, and at the same time perceives that a sinner deserves punishment. Hence, the remorse and the fears with which the consciences of sinners in every age have been tormented. "Wherewithal shall I come before the Lord? Shall I come with thousands of burnt-offerings? Shall I offer my first-born for my transgressions, the fruit of my body for the sin of my soul?" are the anxious inquiries of every sinner who feels conscious that he has violated the laws of Heaven. Hence the numerous modes by which pagan nations have attempted to appease the wrath of their deities; hence their sacrifices, their burnt-offerings, their bodily tortures, their human victims, and the rivers of blood which have flowed in their temples and upon their altars. But reason could never prove that by any of these modes sin could be expiated, and the Deity rendered propitious. Christianity alone unfolds the plan of redemption, and the way by which guilty men may obtain forgiveness and acceptance in the sight of him whose laws they have violated. It declares, "that Christ Jesus died for our offences, and

rose again for our justification;" that "God hath set him forth as a propitiation to declare his righteousness in the remission of sins," and that, having made so costly a sacrifice for the sins of the world, he will refuse nothing that can contribute to the present and everlasting happiness of the believer in Jesus. "He who spared not his own Son, but delivered him up for us all, how shall he not with him also freely give us all things?" Such declarations, when cordially received, are sufficient to allay all the fears of a guilty conscience, to inspire the soul with holy love and gratitude, and to produce "a peace of mind that passeth all understanding."

5. Christianity inculcates *the purest and most comprehensive system of morality.* Its moral requisitions are all comprehended under the two following rules or principles, "Thou shalt love the Lord thy God with all thy heart," and "thou shalt love thy neighbour as thyself," which diverge into numberless ramifications. It could easily be shown, that these principles are sufficient to form the basis of a moral code for the whole intelligent creation, that they are calculated to unite the creature to the Creator, and all rational beings with one another, wherever they may exist throughout the boundless empire of the Almighty; and that peace, order, and happiness would be the invariable and necessary results wherever their influence extended. If the love of God reigned supreme in every heart, there would be no superstition or idolatry in the universe, nor any of the crimes and abominations with which they have been accompanied in our world,—no blasphemy or profanation of the name of Jehovah,—no perjury, hypocrisy, arrogance, pride, ingratitude, nor murmurings under the allotments of Divine Providence. And if every moral intelligence loved his fellow-creatures as himself, there would be no rivalships and antipathies between nations, and, consequently, no wars, devastation, nor carnage,—no tyranny, haughtiness, or oppression among the great, nor envy, discontent, or insubordination among the lower classes of society,—no systems of slavery, nor persecutions on account of religious opinions,—no murders, thefts, robberies, or assassinations,—no treacherous friendships, nor fraud and deceit in commercial transactions,—no implacable resentments among friends and relatives, and no ingratitude or disobedience among

children or servants. On the other hand, meekness, long-suffering, gentleness, humility, temperance, fidelity, brotherly-kindness, and sacred joy would pervade every heart, and transform our world from a scene of contention and misery to a moral paradise. The comprehensive nature of these laws or principles, and their tendency to produce universal order and happiness among all intelligences, form, therefore, a strong presumptive argument of their divine original.

There are certain Christian precepts, different from all that were ever taught by the sages of the pagan world, and in direct opposition to their most favourite maxims, which might be shown to have the same beneficial tendency. For example, it is one of the precepts laid down by the Founder of our religion, "Resist not evil, but whosoever shall smite thee on the right cheek, turn to him the other also," &c.; and in accordance with this precept he propounds the following: "Love your enemies, do good to them that hate you, and pray for them who despitefully use you and persecute you." And he enforces it by one of the most sublime and beautiful motives, "That ye may be the children of your Father who is in heaven, for he maketh his sun to rise on the evil and on the good, and sendeth rain on the just and on the unjust." Now, these precepts of morality are not only original, and peculiar to the Christian system, but they are in direct opposition to all the virtues generally denominated *heroic*, and which are so much celebrated by the poets, philosophers, and historians of antiquity. While the annals of history proclaim that the exercise of the heroic virtues (among which are classed implacability and revenge), has banished peace from the world, and covered the earth with devastation and bloodshed, it could easily be shown, that were the virtues inculcated by our Saviour universally practised, there would not be an enemy on the face of the globe, wars would cease to the ends of the earth, and the whole world would form one vast community of friends and brethren. Whereas, were the opposite dispositions *universal*, and uncontrolled by any counteracting principle, they would produce a scene of universal contention and misery throughout the moral universe. Another disposition peculiar to the Christian system, and which is enforced throughout both the Old and the New Testament, is *humility*. So little was this disposition regarded by the ancient heathen world, that in the classical languages of Greece and Rome there is no word to denote the virtue of humility. It is a quality, however, which results so naturally out of the relation in which man stands to his Maker, and is so correspondent to the low rank which he holds in the scale of universal being, that the religion which so powerfully enjoins it may be said to have "a sign from heaven" that it proceeds from God. And in his intercourses in society, a man will always find that there is a far higher degree of quiet and satisfaction to be enjoyed by humbling himself, than by endeavouring to humble others; for every arrogant and haughty spirit will uniformly smart under the feelings of wounded pride and disappointed ambition.

The Christian virtues to which I have now adverted ought not to be considered as the characteristics of a mean and unmanly spirit, or as contrary to the dignity and energy of the human character. The apostles and first Christians, who uniformly practised these virtues, were distinguished by undaunted fortitude and almost unparalleled intrepidity. They advocated their cause, before princes and rulers, with the utmost dignity and composure; they were ready to suffer the greatest persecutions, and even the most excruciating torments, rather than betray the sacred cause in which they had embarked; and one of them had the boldness, when brought before the Roman governor as a prisoner, to arraign the very vices for which he was notorious, and to make the profligate judge tremble in his presence.* So far from these virtues being mean or unmanly, they are the principal qualities that are justly entitled to the epithet *heroic;* for they are the most difficult to be acquired and sustained, as they run counter to the general current of human passion and feeling, and to all the corrupt propensities of the nature of man. A man may have sufficient heroism to bombard a town, or to conquer an army, and yet be altogether unable to regulate his temper, or subdue his boisterous passions. But "he that is slow to anger is better than the mighty, and he that ruleth his spirit than he that taketh a city." In the one case, we strive against the corrupt affections of our nature; in the other (as in giving vent to implacability and revenge), we give loose reins to our malignant passions. In the one case, we struggle against the stream, in order to obtain safety and repose; in the other, we allow ourselves to be hurried along with the current, regardless of the rocks against which we may be dashed, or the whirlpools in which we may be ingulfed. In proportion, then, as the Christian virtues prevail in any community will quarrels and contentions, and every thing destructive of human enjoyment, be effectually prevented, and happiness diffused among all ranks of society.

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* Acts xxiv. 25.

In short, Christianity, in its moral requisitions, enjoins every relative and reciprocal duty between parents and children, masters and servants, husbands and wives, governors and subjects; and not only enforces the practice of justice and equity in all such relations, but inspires the most sublime and extensive charity,—a boundless and disinterested effusion of tenderness for the whole species, which feels for their distress, and operates for their relief and improvement. It prescribes no self-denial, except with regard to sinful lusts and depraved passions; no mortification, except of evil affections; it gives full scope to every feeling that contributes to the real enjoyment of life, while it guards, by the most awful sanctions, every duty the observance of which is necessary for our present and future happiness. It extends our views beyond the limits of the present state, and shows us that the future happiness of man is connected with his present conduct, and that every action of our lives should have a reference to that immortal existence to which we are destined. But it never insinuates, that earth and heaven are opposed to each other, as to their duties and enjoyments, or that we must be miserable here, in order to be happy hereafter. For while it prescribes rules which have for their ultimate object our happiness in a future world, the observance of these rules is calculated to secure our highest enjoyment even in the present life; and every one who has devoted himself to the practice of genuine Christianity has uniformly found, that "godliness is profitable unto all things, having the promise both of the life that now is, and of that which is to come." On the characteristics of the moral code of Christianity, then, I should scarcely hesitate to rest almost the whole of the internal evidence of its divine original. For laws which have a tendency to unite in a bond of affectionate union the whole intelligent creation,—which, if practised, would undermine every species of moral evil, and promote peace and happiness over all the earth, and which are equally calculated to produce true enjoyment in this world, and to prepare us for the higher felicities of the world to come,—must have had their origin in the mind of that Almighty Being whose omniscient eye perceives all the effects of every principle of action, and all the relations which subsist throughout the moral universe.

6. Christianity explains certain moral phenomena which would otherwise have been inexplicable, and affords strong consolation under the evils of life. It throws a light on the origin of evil, and the disorders both of the physical and moral world, by informing us that man has lost his original happiness and integrity, that the earth has been defiled by his sin and rebellion, and that it is no longer the beautiful and magnificent fabric which it appeared during the period of primeval innocence. On the same ground, it discovers the reason why *death* has been permitted to enter our terrestrial system, and the cause of all those afflictions and calamities to which mankind are subjected. It presents before us principles sufficient to explain most of the apparent irregularities and mysterious operations which appear in the moral government of the Almighty,—why storms and tempests, earthquakes and volcanoes are permitted to produce their ravages,—why the wicked so frequently enjoy prosperity, while the virtuous groan under the pressure of adversity,—why tyranny is established and vice enthroned, while virtue is despised, and love to truth and righteousness sometimes exposes its votary to intolerable calamities. All such occurrences, under the government of God, are accounted for on these general principles,—that they fulfil his counsel,—that they are subservient to the accomplishment of some higher designs of which we are partly ignorant—and that the justice and equity of his procedure will be fully displayed and vindicated in the future world, where "every man will be rewarded according to his works." And as Christianity explains the cause of the physical and moral evils which exist in our world, so it affords strong consolation to the minds of its votaries under the afflictions to which they are now exposed. For, what is death to that mind which considers immortality as the career of its exist-

ence? What are the frowns of fortune to him who claims an eternal world as his inheritance? What is the loss of friends to that heart which feels that it shall quickly rejoin them in a more intimate and permanent intercourse than any of which the present life is susceptible? What are the changes and revolutions of earthly things to a mind which uniformly anticipates a state of unchangeable felicity? As earth is but a point in the universe, and time but a moment in infinite duration, such are the hopes of the Christian in comparison of every sublunary misfortune.

7. Revelation communicates to us a knowledge of facts and doctrines which we could not otherwise have acquired. It informs us, that the Deity existed *alone* innumerable ages before time began,—that the material universe was brought into existence at his command, and by the exertion of his Almighty power,—and that the earth, *in its present form*, had no existence at a period seven thousand years beyond the present. It informs us of the manner in which this globe was first peopled, of the primeval state of its first inhabitants, of their fall from the state of innocence and purity in which they were at first created, of the increase of wickedness which followed the entrance of sin into the world, of the deluge which swept away its inhabitants, and of which the most evident traces are still visible on the surface and in the bowels of the earth,—and of the manner in which Noah and his family were preserved from this universal destruction, for the repeopling of the world. It informs us of the time, manner, and circumstances in which the various languages which now exist had their origin—a subject which completely puzzled all the ancient philosophers, which they could never explain, and on which no other history nor tradition could throw the least degree of light. It unfolds to us views of the state of society in the ages which succeeded the deluge, of the countries into which mankind were dispersed, and of the empires which they founded. It records the history of Abraham, the legislation of Moses, the deliverance of the tribes of Israel from Egypt, their passage through the Red Sea, their journeyings through the deserts of Arabia, under the guidance of the pillar of cloud and of fire, and their conquest of the land of Canaan. It informs us of a succession of prophets that were raised up to announce the coming of Messiah, and to foretel the most

remarkable events that were to take place in the future ages of the world,—of the appearance of Jesus Christ, of the promulgation of his gospel, and the miraculous effects with which it was accompanied. All which events, as explained and illustrated in the Sacred History, form one grand series of dispensations which is, in the highest degree, illustrative of the power, wisdom, goodness, and rectitude of the Supreme Being,—and of which no other records can give us any certain information.

8. *The beneficial effects which Christianity has produced in the world* constitute a most powerful evidence of its divinity. One striking effect it has produced is, the superior light it has thrown on the great objects of religion, and the knowledge it has communicated respecting its moral requisitions. Wherever it has been received, it has completely banished the absurd systems of polytheism and pagan idolatry, with all the cruel and obscene rites with which they were accompanied; and, in their place, has substituted a system of doctrine and practice, not only pure and rational, but level to the comprehension of the lowest class of society. A mechanic or peasant, instructed in the leading principles of revelation, now entertains more just and consistent notions of God, of his perfections, his laws, and the plan of his universal providence, than the most renowned philosophers of ancient times ever acquired. Christianity has produced an influence even on the progress of the arts and of rational science; for wherever it has been established, they have uniformly followed in its train; and the latest discoveries in philosophy, so far from being repugnant to its doctrines and facts, are in perfect consistency with all its revelations, and tend to illustrate many of its sublime annunciations. With regard to *practice*—it has introduced many virtues which were altogether unknown in the heathen world. Instead of sottish idolatry, lasciviousness, unnatural lusts, pride, ostentation, and ambition, it has introduced, among all who submit to its authority, rational piety, humility, moderation, self-denial, charity, meekness, patience under affronts and injuries, resignation to the will of God, brotherly kindness, and active beneficence. In the first ages of Christianity, such virtues were eminently conspicuous.—"See," said the heathen, "how these Christians love one another." Lactantius, one of the early Apologists, was able to say, in the

face of his antagonists, "Give me a man who is wrathful, malicious, revengeful, and, with a few words of God, I will make him calm as a lamb; give me one that is a covetous, niggardly miser, and I will give you him again liberal, bountiful, and dealing out of his money by handfuls; give me one that is fearful of pain and death, and immediately he shall despise racks and crosses, and the most dreadful punishments you can invent."

Its influence on communities and nations is no less evident, in the changes it has introduced in the circumstances of domestic life, and the barbarous practices it has completely abolished. When it made its way through the Roman empire, it abolished the unnatural practice of polygamy and concubinage, reduced the number of divorces, and mitigated the rigour of servitude, which, among the Romans, was cruel and severe—masters being often so inhuman as to remove aged, sick, or infirm slaves into an island in the Tiber, where they suffered them to perish without pity or assistance. Polished and polite as the Romans have been generally considered, they indulged in the most barbarous entertainments. They delighted to behold men combating with wild beasts and with one another; and we are informed by respectable historians, that the fights of *gladiators* sometimes deprived Europe of twenty thousand lives in one month. Neither the humanity of Titus, nor the wisdom and virtue of Trajan, could abolish these barbarous spectacles, till the gentle and humane spirit of the gospel put a final period to such savage practices, and they can never again be resumed in any nation where its light is diffused, and its authority acknowledged. It humanized the barbarous hordes that overturned the Roman empire, and softened their ferocious tempers, as soon as they embraced its principles and yielded to its influence. It civilized, and raised from moral and intellectual degradation, the wild Irish, and our forefathers the ancient Britons, who were classed among the rudest of barbarians till the time when they were converted to the religion of Jesus; so that the knowledge we now see diffused around us, the civilization to which we have advanced, the moral order which prevails, the beauties which adorn our cultivated fields, the comforts and decorations connected with our cities and towns, and the recent improved state of the arts and sciences, may all be considered as so many of the beneficial effects which the Christian religion has produced among us.

In our own times, we have beheld effects no less powerful and astonishing, in the moral revolution which Christianity has lately produced in Tahiti, and the adjacent islands in the Southern Ocean. In this instance, we behold a people who, a few years ago, were among the most degraded of the human race—who were under the influence of the most cruel superstitions and idolatries—who adored the most despicable idols—who sacrificed on their altars multitudes of human victims, and were plunged into all the vices and debaucheries, and vile abominations which can debase the character of man—we behold them now transformed into civilized and Christian societies—their minds enlightened in the knowledge of the true God, their tempers moulded into the spirit of the religion of Jesus,—their savage practices abolished,—industry, peace, and moral order spreading their benign influence on all around, and multitudes rejoicing in the prospect of a blessed immortality. Where barrenness and desolation formerly prevailed, and where only a few savage huts appeared, open to the wind and rain, beautiful villages are now arising, furnished with all the comforts and accommodations of civilized life. Where pagan altars lately stood, and human victims were cruelly butchered, spacious temples are now erected for the worship of "the God and Father of our Lord Jesus Christ," and seminaries for the literary and religious instruction of the young. Where sanguinary battles were fought, amid the furious yells of savage combatants, who cruelly massacred every prisoner of war, the voice of rejoicing and of thanksgiving is now heard ascending to Heaven from the peaceable "dwellings of the righteous,"—all which effects have been produced, within less than twenty years, by the powerful and benign agency of the gospel of peace.*

Even *war* itself—the most disgraceful and diabolical practice in which mankind have indulged, and which will affix an eternal stigma on the human character—even war has assumed something of the spirit of mildness and humanity, compared with the savage ferocity with which it was conducted during the reign of heathenism. Prisoners are no longer massacred in cold blood; the conquered are spared, and their liberty frequently restored; and, were the principles of Christianity recognised, and universally acted upon by professing Christian nations, the spirit of warfare would soon be wholly exterminated, and peace would extend its benign influence over all the kingdoms and families of the earth. The celebrated Montesquieu, in his "Spirit of Laws," has observed, "The mildness so frequently recommended in the gospel is incompatible with the despotic rage with which an arbitrary tyrant punishes his subjects and exercises himself in cruelty. It is the Christian religion which, in spite of the extent of empire and the influence of climate, has hindered despotism from being established in Ethiopia, and has carried into Africa the manners of Europe. The heir to the throne of Ethiopia enjoys a principality, and gives to other subjects an example of love and obedience. Not far from hence may be seen the Mohammedan shutting up the children of the king of Senaar, at whose death the council sends to murder them in favour of the prince who ascends the throne."—"Let us set before our eyes, on the one hand, the continual massacres of the kings and generals of the Greeks and Romans, and on the other the destruction of people and cities by the famous conquerors Timur Beg and Jenghis Kan, who ravaged Asia, and we shall perceive, that we owe to Christianity in government a certain political law, and in war a certain law of nations, which allows to the conquered the great advantages of liberty, laws, wealth, and always religion, when the conqueror is not blind to his own interest."

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* For a particular account of this moral revolution which has recently taken place in the *Society* and other islands of the Pacific, the reader is referred to "Ellis's Polynesian Researches," 4 vols. 12mo.

But Christianity has not only abolished many barbarous practices, it has likewise given birth to numerous benevolent institutions and establishments altogether unknown in pagan countries. Let us consider the numerous schools for the instruction of youth in useful knowledge and in the principles of religion, which are erected in all towns and villages in Christian countries, the numerous churches and chapels devoted to the worship of God, and to the instruction and comfort of individuals of every condition, age, and sex,—the colleges and academies which have been founded for imparting knowledge in literature, and in arts and sciences, —the numerous philanthropic societies which have been formed for the relief of the aged, the infirm, and the destitute sick,—the education of the deaf and dumb,—the reformation of the criminal code,—the improvement of prison discipline,—the reformation of juvenile offenders,—the aiding of the friendless, the orphan, and the widow,—the literary and moral instruction of the children of the poor,—the relief of destitute imprisoned debtors,—the improvement of the domestic condition of the labouring classes,—the promotion of permanent and universal peace,—the diffusion of the knowledge of the Christian religion throughout every region of the globe, and for various other benevolent purposes, all calculated to alleviate the distresses of suffering humanity, to extend the blessings of knowledge, and to communicate enjoyment to all ranks of mankind; and we may challenge the enemies of our religion to point out similar institutions in any pagan country under heaven that has never felt the influence of Christianity. And if such beneficent effects are the native result of the benevolent and expansive spirit of Christianity, they form a strong presumptive evidence, independently of any other consideration, that it derived its origin from that Almighty Being who is good to all, and whose "tender mercies are over all his works."

In fine, Christianity is adapted to every country and every clime. Its doctrines and precepts are equally calculated to promote the happiness of princes and subjects, statesmen and philosophers, the high and the low, the rich and the poor. It is completely adapted to the nature and necessities of man; its rites are few and simple, and may be observed in every region of the globe. It forbids the use of nothing but what is injurious to health of body or peace of mind, and it has a tendency to promote a friendly and affectionate intercourse among men of all nations. And, as it is calculated for being universally extended, so its prophets have foretold that its blessings shall ultimately be enjoyed by all nations. In the period in which we live, we behold such predictions more rapidly accomplishing than in former times, in consequence of the spirit of missionary enterprise which now pervades the religious world. And when it shall have extended a little farther in its progress, and shall have brought a few more kingdoms and islands under its authority, its beneficent effects will be more clearly discerned, and the evidences of its celestial origin will appear with a force and power which its most determined adversaries will not be able to gainsay or resist.

In proportion as the physical sciences advance, and the system of nature is explored, will the harmony between the operations of the Creator in the material world and the revelations of his Word become more strikingly apparent. Ever since philosophy began to throw aside its hypothetical assumptions and theoretical reasonings, and to investigate nature on the broad basis of *induction*, its discoveries have been found completely accordant with the Scriptures of truth, and illustrative of many of the sublime sentiments they contain. Geology, when in its infancy, was eagerly brought forward by a few skeptical and superficial minds, to subserve the cause of infidelity. A few pretended facts, of an insulated nature, were triumphantly exhibited, as insuperable objections to the truth of the Mosaic history and chronology. But later and more accurate researches have completely disproved the allegations of such skeptical philosophers, and were they now alive, they would feel ashamed of their ignorance, and of the fallacious statements by which they attempted to impose on the credulity of mankind. As geology advances in its investigations, along with its kindred sciences, the facts which it is daily disclosing appear more and more corroborative of the description given in the Bible of the original formation and arrangement of our globe, and of the universal deluge. And, therefore, we have every reason to conclude, that when science and art shall have arrived at a still higher point of perfection, and our terrestrial system shall have been more thoroughly explored throughout all its departments, arguments will be derived from philosophy itself in support of the divinity of our religion, which will carry irresistible conviction to every mind.

Such is a very brief summary of the internal evidences of the Christian religion. It is distinguished by the dignity and sublimity of the style and sentiments of the writings which contain its revelations,—it exhibits the most rational and consistent views of the attributes of the Divine Being,—it gives us full assurance of a future state of immortality,—it points out the way by which pardon of sin and deliverance from moral evil may be obtained,—it exhibits the purest and most comprehensive system of morality,—it explains certain moral phenomena which would otherwise have been inexplicable,—it affords strong consolation under the evils of life,—it communicates the knowledge of interesting facts and doctrines which can be found in no other record,—it has produced the most beneficial effects on the state of society wherever it has been received,—it is completely adapted to the necessities of man, and calculated for being universally extended over the world: to which we might have added, that it is consistent in all its parts, when viewed through the medium of enlightened criticism, and harmonizes with the principles of sound reason, and the dictates of an enlightened conscience. These are characteristics which will apply to no other system of religion that was ever proposed to the world; and if Christianity, accompanied with such evidences, is not divine in its original, we may boldly affirm that there is no other religion known among men that can lay claim to this high prerogative. But we do not think it possible that the mind of man can receive a more convincing demonstration of the truth of Christianity than is set before us in the authentic facts on which it rests, in its tendency to produce universal happiness, and in the intrinsic excellence for which it is distinguished. That man, therefore, by whatever appellation he may be distinguished, who sets himself in opposition to the spirit of this religion, and endeavours to counteract its progress, must be considered as not only destitute of true taste and of moral excellence, but as an enemy to the happiness of his species. If the religion of the Bible is discarded, we are left completely in the dark with regard to every thing that is most interesting to man as an intellectual being, and as a moral and accountable agent. We should, in this case, have the most imperfect conceptions of the attributes of Deity, and should know nothing of his designs in giving us existence, and placing us in this part of his empire,—we should remain in ignorance whether the world had a beginning or had existed from eternity, or whether we shall ever have an opportunity of beholding the grand system of the universe a little more unfolded,—we should be destitute of any fixed moral laws to direct us in our social transactions and intercourses,—we should be entirely ignorant of the principles and objects of the moral government of the Almighty,—we should be destitute of any consolation under the afflictions and calamities of life,—we should hang continually in doubt whether death is to put a final termination to our being, or convey us to another and an eternal state of existence; and, at length, we should be plunged into the gulf of universal skepticism, into which every rejecter of revelation ultimately sinks.

It may not be improper to remark, that the religion to whose characteristics I have now adverted is not to be considered as precisely that form of Christianity which has been established in Italy, in Germany, in Russia, or in Britain; or as it is professed by Episcopalians, Presbyterians, Independents, or any other sect; or as it is expounded in the catechisms, confessions, or systems of divinity, which have been published by the different denominations of the Christian world. In all these cases, its true glory has been obscured, its beauty defaced, and its purity contaminated, by passing through the atmosphere of human folly and corruption; and opinions and practices have been incorporated with its leading principles altogether repugnant to the liberal and expansive spirit for which it is distinguished. *It is to the Christianity of the Bible alone to which I refer.* It is there alone that it is to be seen in its native purity, simplicity, and glory; and he who neglects to study the Scriptures, unfettered by the trammels of human systems, will never be able fully to perceive or to appreciate the true excellence of that religion, which is "pure and peaceable, full of mercy and good fruits," and which breathes "good-will towards men." For, in some of the forms which Christianity has assumed in certain countries, it has been so much blended with human inventions as to be scarcely distinguishable from heathenism; and consequently, in such cases, it has seldom been accompanied with those beneficial effects which it is calculated to produce. And, among almost all the sectaries in every country, either some of its distinguishing features have been overlooked, or its doctrines mixed up with metaphysical dogmas, or its practical bearings disregarded, or opinions respecting its forms and circumstantials set in competition with its fundamental truths and moral requisitions. "Nevertheless, the foundation of God standeth sure,"—and the Divine fabric of Christianity will remain unshaken and unimpaired, so long as the Scriptures are preserved uncontaminated and entire.

The evidences to which I have now adverted *are continually increasing* in their clearness and force. Time, which is gradually undermining the foundations of error, is enlarging the bulwarks of truth, and adding to their strength and stability. Opposition has tended only to clear away the rubbish which has been thrown around the Christian fabric, but it has shown its foundations to be firm and impregnable. The *historical* evidence has been gaining strength ever since the days of the apostles, and since the time when Herbert, Chubb, Tindal, Morgan, and other infidel writers attempted to undermine the cause of revealed religion. The defences which were published by Grotius, Stillingfleet, Butler, Leland, Watson, Paley, and others, have shown, that the more the arguments for Christianity have been opposed, sifted, and examined, the more irresistible have they appeared, and the more have they shone with increasing brightness; so that no infidel has ever attempted to meet them on fair grounds.—The evidence from *prophecy*, from its very nature, is continually progressive; and, in proportion as Scripture predictions are studied with judgment and intelligence, and compared with the history of past ages and the present state of the nations, will a new light be thrown on the prophetical writings, which will cause the evidence of their divinity to shine forth with a brighter lustre, and enable every intelligent observer to read, in passing events and in the revolutions of empires, the faithfulness of the Almighty in accomplishing those declarations which, "at sundry times and in divers manners, he spake to the fathers by the prophets." The *internal* evidence, which has been more overlooked than it ought to have been, is likewise increasing, and will continue to increase, in proportion as the Scriptures are perused with judgment and care, as nature is contemplated with humility and reverence, and as useful knowledge is diffused over the world. When the holy principles of our religion shall have acquired a greater influence over the tempers and conduct of its professors; when the deliberations of statesmen and the conduct of states and empires shall be directed by its maxims and laws; when Christianity shall be divested of the false drapery with which its pretended friends have attempted to adorn it, and freed from the corruptions which human folly has incorporated with its institutions; when all who recognise its leading doctrines, throwing aside party disputes and animosities, shall form themselves into one grand and harmonious association; when a few more portions of the heathen world shall have been brought into subjection to the Prince of Peace, and when the general happiness resulting from such events shall be felt and acknowledged,—then, all who behold such blessed transformations will be enabled to read, in characters that cannot be mistaken, that the Creator of the Universe is the original author of Christianity, and that the promotion of the best interests of mankind is the great end of all its revelations.

My intention in giving the preceding summary of the evidences of Christianity is to show, that, without habits of rational thinking and a certain portion of general information, these evidences cannot be thoroughly investigated, nor their weight and importance duly appreciated. For, how can a mind unaccustomed to reading and reflection be supposed capable of entering into all the topics and considerations requisite to be attended to in such investigations,—of balancing arguments,—of comparing prophecies with their accomplishment in the history of nations,—of detecting sophisms—or of feeling the force of reasonings, however clear or powerful? It is destitute of those fundamental principles and general ideas on which all moral ratiocinations are grounded. On such a mind, the most weighty arguments and the most cogent reasoning make no sensible impression. It may be susceptible of being biased against religion by the sneers and sarcasms of jovial companions, and the ridicule with which they may treat the truths of revelation; but it is unqualified either to rebut such impertinences, or to appreciate the excellences of Christianity, the foundation on which it rests, and the benignant tendency of its doctrines and precepts. And if, in the present day, a man has no acquaintance with the grounds and reasons of revealed religion, and the evidences on which its truth and divinity rest, he will not only be indifferent to the observance of its precepts, and destitute of its supports and consolations, but will be constantly liable to be turned aside to the paths of folly and intemperance, and to become the prey of unthinking fools and scoffing infidels. Whereas, when a man can give a reason of the hope that is in him, his religion becomes a delightful and a rational service, and he is enabled to put to silence the scoffs and vain cavillings of foolish and unreasonable men.

Besides assisting us in investigating the evidences of religion—a certain portion of general information is highly useful, and even necessary, *for enabling us to understand the Sacred writings*. It is true, indeed, that the leading doctrines of revelation, respecting the attributes of God, the mediation of Christ, the way in which salvation is to be obtained, the grand principles of moral action, and the duties connected with the several relations of life, are detailed with such plainness and perspicuity as to be level to the comprehension of every reflecting mind, however unskilled in literature or science. But there are certain portions of Revelation, necessary "to make the man of God perfect," the study of which requires the exertion of all our faculties, and the application of every branch of human knowledge we can possibly acquire. This arises from the very nature of the subjects treated of, and from the limited faculties of the human mind. To illustrate this idea is the object of the following remarks.

1. A considerable portion of Scripture is occupied with *prophetical declarations*,—in referenee to events which have long since taken place, to those which are now happening, and to those which will hereafter happen in the future ages of the world. It contains a series of predictions which embrace the leading outlines of the history of the world, from its commencement to its final consummation. Now, in order to trace the accomplishment of these predictions, and to perceive clearly the events to which they refer, a minute acquaintance with *ancient and modern history* is indispensably requisite; for it is in history, either sacred or civil, that their accomplishment is recorded. And could we, with one comprehensive glance, take a survey of all the leading events which the history of the world records, we should be enabled, when reading the prophetical writings, to perceive at every step the ideas and purposes of that All-comprehensive Mind that "knoweth the end from the beginning,"

and his faithfulness in accomplishing the promises, and executing the threatenings, of his Word. A knowledge of *chronology* is also requisite, in order to ascertain the time in which predictions were uttered, and the periods to which they refer—and of *ancient geography*, to determine the localities of those tribes or nations to which the prophecies have a reference, and their relative positions with regard to each other. In particular, it is necessary to be acquainted with the *figurative style* in which prophecy is conveyed, in order to understand the writings of the ancient prophets. These writings, in common with those of most of the Eastern nations, are highly poetical, and abound in allegories, parables, and metaphors. The *allegory* is that mode of speech in which the writer or speaker means to convey a different idea from what the words in their primary signification bear. Thus, "Break up your fallow-ground, and sow not among thorns,"* is to be understood, not of tillage, but of repentance; and these words, "Thy rowers have brought thee into great waters, the east wind hath broken thee in the midst of the seas,"† allude, not to the fate of a *ship*, but to the fate of a *city*. Of all the figures used by the prophets, the most frequent is the *metaphor*, by which words are transferred from their plain and primary to their figurative and secondary meaning. One of the most copious sources of those metaphors to which the sacred writers resort is *the scenery of nature*. The sun, moon, and stars, the highest and most splendid objects in the natural world, figuratively represent kings, queens, and princes or rulers, the highest in the political world, as in the following passages, "The moon shall be confounded, and the sun ashamed."‡ "I will cover the heavens, and make the stars thereof dark; I will cover the sun with a cloud, and the moon shall not give her light."§ *Light* and *darkness* are used figuratively for joy and sorrow, prosperity and adversity; as, "We wait for light, but behold obscurity; for brightness, but we walk in darkness;"||—and likewise for knowledge and ignorance,—"The people that walked in darkness have seen a great light," &c. Immoderate rains, hail, floods, torrents, inundations, fire, and storms denote judgments and destruction; Lebanon, remarkable for its height and its stately cedars, is used as an image of majesty and strength; Carmel, which abounded in vines and olives, as an image of fertility and beauty; and bullocks of Bashan, rams, lions, eagles, and sea-monsters, as images of cruel and oppressive conquerors and tyrants. Metaphors are likewise borrowed from history, from the scenery of the temple and its various utensils and services, and from the ordinary customs and occupations of life—the meaning and application of which require to be distinctly understood, in order to perceive the spirit and references of ancient prophecy. Those who would wish to study this subject with intelligence would do well to consult the works of Lowth, Hurd, Sherlock, Kennicot, Newcome, and particularly "Newton's Dissertations on the Prophecies."

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* Jer. iv. 3.
† Ezek. xxvii. 26.
‡ Isaiah xxiv. 23.
§ Ezek. xxxii. 7.
|| Isaiah lix. 9.

2. In studying the *historical parts of Scripture*—a knowledge of ancient history, and even of Pagan mythology, tends, in many instances, to throw light on the narratives of the Sacred writers. We find, from heathen writers, who were strangers to the Jewish religion, that the most ancient tradition of all nations, respecting the early history of the world, is exactly agreeable to the relation of Moses, though expressed in a more abstruse, doubtful, and imperfect manner. The description of the origin of the world in the ancient Phenician history, translated by *Philo Biblius* from *Sanchoniathon's* collection, and transmitted to us by *Eusebius*, is materially the same with that which is recorded in the Book of Genesis, when separated from the fabulous notions with which it is blended. The Egyptians, according to Laertius, acknowledged, "that originally the world was a confused chaos, from whence the four elements were separated, and living creatures made; and that the world had a beginning, and consequently would have an end." Hesiod, the most ancient writer whose works have reached us, says, that "all things had their origin from a rude chaos;" and Ovid, in the first book of his "Metamorphoses," tells us, "that before the seas, and the land, and the canopy of heaven existed, there was one appearance throughout the whole of nature, which they called *chaos*—a rude and indigested mass, in which earth and air, fire and water, were indiscriminately mixed. In short, Thales, Anaxagoras, Aratus, Virgil, and Homer, speak of the original of

all things, conformable to the account given by Moses, though in a different phraseology; and we learn from Josephus, Philo, Tibullus, Clemens Alexandrinus, and Lucian, that the memory of the six days' work was preserved, not only among the Greeks and Italians, by honouring the seventh day, but also among the Celtæ and Indians, who all measured their time by weeks. Manetho, who wrote the history of the Egyptians, Berosus, who wrote the Chaldean history, Hierom, who wrote the history of Phenicia, and Hecatæus, Hillanicus, and Ephorus, who wrote the history of Greece, all agree in asserting, "that those who descended from the first men, in the first ages of the world, lived many of them nearly a thousand years." With regard to *the deluge*, we find most of the Greek and Roman writers, Ovid, Lucian, Berosus the Chaldean, Abydenus the Assyrian, and many others referring to that great event, and detailing the particular circumstances connected with it, in language nearly similar to that of the sacred historian; such as the preservation of Noah, the ark in which he was preserved, the mountain on which it rested, the dove and the raven which he is said to have sent out, and the wickedness of the antediluvians, as the cause of that dismal catastrophe. We find, also, that the whole mythology of India is full of allusions to the general deluge, which appears to be the commencement of their present era; and that accounts of the same event are to be met with in China and Japan.*

An acquaintance with ancient history is necessary for enabling us to fill up the blanks left by the sacred historians. From the time of Ezra and Nehemiah to the birth of Christ, there is an interval of about four hundred and fifty years, of the events which happened during which we have no account in any part of the inspired writings. A knowledge of the events which happened during this interval is necessary, in order to complete our views of the scheme of Divine Providence, and to unfold to us the series of God's dispensations in relation both to the Jews and the surrounding nations. During this period, too, many of the predictions of Daniel and the other prophets received their accomplishment,—particularly those which relate to the Medes and Persians, the Macedonian empire, the times of Alexander the Great, Ptolemy Philadelphus, Antiochus Epiphanes, Philip of Macedon, and the persecutions in the days of the Maccabees. In order, therefore, to obtain a clear and comprehensive view of the ways of Providence during this interval, such works as Shuckford's "Connexion of Sacred and Profane History," and Prideaux's "Connexions of the Old and New Testament" require to be studied with care, in many parts of which will be seen a running commentary on Daniel's vision of the "Ram and He-goat," and of "the things noted in the Scripture of truth," which have a reference, among other things, to the kings of Persia, to Alexander and his successors, and the warlike expeditions in which they were engaged. For an elucidation of the general train of events from the Mosaic creation to the establishment of Christianity, "Stackhouse's History of the Bible," in six volumes 8vo, or in three volumes 4to, with the additional notes and dissertations of Bishop Gleig, will be found an invaluable treasure, and will amply repay the reader who gives it a diligent perusal.*

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* See Maurice's "Indian Antiquities," and Bryant's "System of Mythology."

3. A knowledge of the manners and customs, climate and seasons, arts and sciences of the Eastern nations, is essentially requisite, in many instances, in order to understand the allusions of the sacred writers, and the meaning of various portions of Scripture. For example, when an untutored reader peruses the account given in the Evangelists of the cure of the paralytic who was carried by four men on a bed, and who, finding it impossible to pass through the throng, ascended to the top of the house in which Jesus was, and let him down, bed and all "through the tiling," into the very room where he was sitting—he is apt to entertain a

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* In Bishop Gleig's edition of Stackhouse's history, a long and useful dissertation, entitled "An Apparatus to the History of the Bible," has been left out without any reason being assigned for the omission. In other respects the original work appears to be complete. Bishop Gleig's improvements consist chiefly in bringing forward the discoveries of modern science for the purpose of elucidating certain scriptural facts, and repelling the objections of infidels—and in various dissertations on some of the leading doctrines and historical facts of revelation, which form valuable additions to the original work of Stackhouse. See also *Horne's Introduction*, &c.

very confused and erroneous idea of the circumstances of the case, when his attention is directed solely to the mode of building in this country. But when he is informed that the houses in the country of Judea were low-built and flat-roofed, and surrounded with a parapet breast-high, that there was a ladder or pair of stairs which led to the top of the house from the outside, and a trap-door or hatchway in the middle of the roof—he will soon acquire a clear idea of the circumstances stated in this and other parts of the evangelical history, and of the ease with which the paralytic man might be conveyed to the top of the building, and let down through the roof. The same facts likewise illustrate the circumstance of Peter's going to the top of the house to pray, and the custom of making proclamations from the house-tops, to which there are several allusions in Scripture. A knowledge of the weather and seasons of Judea is frequently of use to illustrate the force of certain expressions of the sacred writers. It may seem to us nothing extraordinary that there should be "thunder and rain in harvest," or in the months of June and July, when Samuel said, "Is it not *wheat harvest* to day? I will call unto the Lord, and he shall send thunder and rain,"* But Jerome, who lived in Judea many years, says, it never rained there at that season; so that the thunder and rain which happened at the intercession of Samuel were truly miraculous, and as such, "the people greatly feared the Lord and Samuel." Again, in Luke xii. 55, it is said, "When ye see the south wind blow, ye say there will be heat, and it cometh to pass." In our climate, where the south wind seldom blows, this may not be always the case. But in Syria, Egypt, Judea, and the adjacent countries, the effect here mentioned is striking and uniform. When the south wind begins to blow the sky becomes dark and heavy, the air gray and thick, and the whole atmosphere assumes a most alarming aspect. The heat produced by these southern winds has been compared to that of a huge oven at the moment of drawing out the bread, and to that of a flame blown upon the face of a person standing near the fire that excites it.

Thousands of illustrations of Sacred Scripture may be derived from such sources; and he who is unacquainted with them must remain a stranger to the beauties of the style of the inspired writers, and to the precise meaning of many portions both of the historical and the prophetical writings. The manners and customs of the Eastern nations have remained nearly the same for several thousand years; so that those which are found existing in the present day are exactly, or nearly the same, as those which prevailed in the times when the books of the Old and New Testaments were written. Modern oriental travellers, in their descriptions of the arts, sciences, and manners of the East, have furnished us with a mass of invaluable materials for the elucidation of holy writ, and they have proved, in many cases, unintentionally, better commentators than the most profound critics and philologists. Many of their insulated remarks of this kind have lately been classified and arranged by various writers, particularly by Harmer, in his "Observations," Burder in his "Oriental Customs," Paxton in his "Illustrations," and Taylor, the late learned editor of the new editions of Calmet's Dictionary, in his *Fragmenta*, appended to that work, which contains an immense number of such observations, illustrated with a great variety of engravings.

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* 1 Samuel xii. 17

4. An acquaintance with *Ancient Geography*, especially that part of it which relates to the Eastern countries, would enable a person to peruse many portions of Scripture with much greater interest and intelligence, than if he were altogether ignorant of this branch of knowledge. In the history of the Old Testament, and in the Prophetical writings, there are frequent references and allusions to Mesopotamia, Idumea, Egypt, Assyria, Chaldea, Arabia, Ethiopia, Lybia, Parthia, Scythia, Persia, and other countries—to the cities of Jerusalem, Babylon, Nineveh, Damascus, Tadmor, Tyre, Sidon, &c.—to the great Sea, or the Mediterranean, the Dead Sea, the Sea of Tiberias, the Red Sea—the isles of Chittim, Cyprus, Crete, Melita—the rivers Jordan, Kishon, Jabbok, Euphrates, Hiddekel, Pison, Ulai, Abana, Pharpar, &c.—Now, a knowledge of the positions of such places with respect to the country of Judea, their relative situations with regard to each other, and of the outlines of their history, and of the warlike achievements and commerce of their inhabitants—is frequently necessary, in order to attain a clear and comprehensive view of the passages in which there are allusions to such localities.—In reading the

Evangelists, it is highly expedient to know, for example, the position of Samaria, Galilee, the lake of Gennesareth, and the river Jordan, with respect to that portion of the Holy Land denominated Judea—the situations of Bethlehem, Nazareth, Jericho, Nain, Sychar, Bethsaida, Cana, Tyre and Sidon, with respect to Jerusalem, and their respective distances from that metropolis—and the characteristics of the inhabitants of these places; for, upon a knowledge of such circumstances, our perception of the beauty and appropriateness of our Saviour's discourses, and of the propriety of his actions, will, in a great measure, depend.—In reading the history of the journeyings of the Apostles, it is no less expedient that we have lying before us maps of Asia Minor, of Ancient Greece, of Palestine, of the eastern parts of Africa, and of the islands of the Mediterranean, and that we have some acquaintance with the history and character of the tribes which inhabited these countries in the days of the Apostles. Without such knowledge and assistances, we must, in many instances, read their narratives without ideas—and shall be unable to appreciate their labours, the long journeys they undertook, the fatigues they endured, the dangers to which they were exposed by sea and land, and the allusions made to such circumstances in the Apostolic Epistles.*

5. An acquaintance with the facts of Natural History and Science, and with the general phenomena of Nature, would tend to throw a light on many passages of Scripture, and would enable persons to perceive a beauty and an emphasis in certain expressions, which they would otherwise be apt to overlook. For example, in the beginning of the hundred and thirty-fifth psalm, the servants of God are exhorted to "praise the name of Jehovah;" and in the sequel of the psalm various *reasons* are assigned why we should engage in this exercise. One of these reasons is, that "*He causeth the vapours to ascend from the ends of the earth.*" Many persons who read or who may sing this portion of sacred poetry

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* The student of ancient geography will be assisted in his researches by a perusal of Wells' "Set of Maps of Ancient Geography," twenty-three in number—and Wells' 'Sacred Geography," modernized by the Editor of Calmet's Dictionary, which is one of the most accurate and complete works of the kind.

would be apt to overlook the circumstance now stated as an argument of very inferior importance. But if we examine the subject attentively, we shall find, that this physical operation of the Almighty is not only very wonderful in its nature, but that upon it most of our comforts, and even our very existence, depend. *Evaporation* is a process by which water and other liquids are converted into vapour. The matter of *heat*, combining with water, renders it specifically *lighter*, by which means it rises and mixes with the atmosphere, where it remains either *invisible*, or assumes the appearance of clouds. In this state it occupies a space fourteen hundred times greater than in its ordinary liquid state, and consequently is much lighter than the atmospheric air into which it rises. It has been calculated, that, from an acre of ground, during twelve hours of a summer's day, more than 1600 gallons of water have been drawn up into the air in the form of vapour. From the whole surface of the ocean there arise, every twelve hours, no less than 30,320,500,000,000, or more than thirty millions of millions of cubic feet of water, which is more than sufficient to supply all the rivers that intersect the four quarters of the globe. This immense body of vapour is formed into clouds, which are carried by the winds over every part of the continents; and, by a process with which we are still unacquainted, is again condensed into rain, snow, or dews, which water and fertilize the earth. Now, if this wonderful and extensive process of nature were to cease—we might wash our clothes, but centuries would not dry them, for it is evaporation alone that produces this effect—there would be no rains nor dews to fertilize our fields, and the consequence would be, the earth would be parched, and the vegetable productions which afford us subsistence would wither and decay,—the rivers would swell the ocean, and cause it to overflow a portion of the land, while, at the same time, their sources would soon be completely exhausted, and their channels dried up. In such a state of things, the whole system of terrestrial nature would be deranged, and man, and all the other tribes of animated nature—deprived of those comforts which are essential to their existence—would, in a short time, perish from the earth. So that it forms a powerful and impressive motive to excite us to praise the name of Jehovah, when we call to remembrance, that it is He "who causeth the vapours to ascend from the ends of the earth," and thus preserves the harmony of nature, and secures to all living creatures the blessings they now enjoy.

Again, we are informed by Solomon (Eccles. i. 7), that "all the rivers run into the sea; yet the sea is not full; *unto the place from whence the rivers come, thither they return again.*" It appears, at first sight, somewhat unaccountable, that the ocean has not long ere now overflown all its banks, when we consider that so many majestic streams are incessantly rolling into its abyss, carrying along with them into its caverns no less than thirteen thousand six hundred cubical miles of water every year. Solomon partly solves the difficulty, by informing us, that, "to the place whence the rivers come, thither they return again." But how do they return? Many expositors of Scripture attempt to explain this circumstance, by telling us that the waters of the ocean percolate through the earth, and in some way or another, arrive near the tops of mountains, where springs generally abound. But such a supposition is not only highly improbable, when we consider the vast mass of earth and rocks, several hundreds of miles in thickness, through which the waters would have to percolate, but *directly contrary* to the known laws of nature; for *no fluid can rise in a tube above the level of its source*, which in this case it behooved to do. Modern experiments and discoveries, however, have satisfactorily accounted for this fact, on the principle of *evaporation*, to which I have just now adverted. From the surface of the ocean and of the rivers themselves, there is carried up into the atmosphere, in the form of vapour, nearly three times the quantity of water sufficient to replenish the sources of all the rivers in the world. The vapour thus raised is carried by the winds, in the form of clouds, over every region of the globe, and falls down in rains to carry on the various processes of nature. One part falls into the sea, another on the lowlands, and the remaining part is sufficient to replenish the sources of all the rivers. So that the assertion of Solomon is strictly and philosophically correct, that "to the place whence the rivers come, thither they return again." They first fall into the ocean; a portion of their waters is then raised by evaporation into the atmosphere; this portion of vapour, after traversing the regions of the air, falls down in rain, mists, and dews, and supplies the numerous springs "which run among the hills."

Such illustrations, which might be indefinitely extended, not only throw a light on the meaning of the sacred writers, but tend likewise to show the harmony that subsists between the discoveries of science and the truths of revelation. As the author of Christianity and the author of the system of nature is one and the same Being, there must exist an harmonious correspondence between *truth* in the one, and *fact* in the other; and the more they are studied with intelligence, and in connexion with each other, the more will their harmony be apparent.

It is a circumstance that has frequently forced itself upon my attention, that whatever scene of nature we contemplate, and however brilliant and unexpected the discoveries which modern science has brought to light,—however far they have carried our views into the wonders of the minute parts of creation, and into the immeasurable regions of space, where myriads of suns are lighted up,—and however much the mind may be lost in astonishment and wonder, at the magnificent scenes which they disclose,—we shall find sentiments and expressions in Scripture adequate to express every emotion of the soul when engaged in such contemplations.—Are we contemplating the expanse of the ocean, and the vast mass of waters which fill its mighty caverns? and do we wish to raise our thoughts in adoration of the power of that Almighty Being who formed it by his word? We are presented by the inspired penmen with expressions in which to vent our emotions. "He holds its waters in the hollow of his hand; he taketh up its isles as a very little thing." "He gathereth the waters of the sea together as a mass; he layeth up the depths as in storehouses." "He divideth the sea by his power; he hath compassed the waters with bounds, until the day and night come to an end." "Thou coveredst the earth with the deep as with a garment; the waters stood above the mountains:* At thy rebuke they fled; at the voice of thy thunder they hasted away. Thou hast set a boundary that they may not pass over, that they turn not again to cover the earth." "He hath placed the sand for the bounds of the sea, by a perpetual decree, that it cannot pass it; and though the waves thereof toss themselves, yet can they not prevail; though they roar, yet can they not pass over it." He hath said to its rolling billows, "Hitherto shalt thou come, and no farther; and here shall thy proud waves be stayed."—Are we spectators of storms and tempests, especially in the terrific grandeur they display in southern climes? Our emotions will be expressed with the greatest emphasis in the language of inspiration, in which we are uniformly directed to view the agency of God in such phenomena. "Clouds and darkness are round about him: He hath his way in the whirlwind and the storm, and the clouds are the dust of his feet." "When he uttereth his voice, there is a sound of waters in the heavens; he causeth the vapours to ascend from the ends of the earth; he maketh lightnings with rain, and bringeth forth the winds out of his treasuries." "The God of glory thundereth; the voice of the Lord is full of majesty; the voice of the Lord divideth the flames of fire; yea, the Lord breaketh the cedars of Lebanon." "Who can stand before his indignation? The mountains quake before him, the hills melt, and rocks are shivered at his presence."

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* Referring to the deluge.

Again, when we contemplate the immense number and variety of animated beings which glide through the waters, move along the earth, and wing their flight through the air; together with the ample provision which is made for their accommodation and subsistence,—where can we find language more appropriate to express our feelings than in these words of the Psalmist? "How manifold are thy works, O Lord! In wisdom hast thou made them all; the earth is full of thy riches; so is the great and wide sea, wherein are things creeping innumerable, both small and great beasts. These all wait upon thee, that thou mayest give them their meat in due season. Thou givest them,—they gather; thou openest thine hand,—they are filled with good."—When we survey the structure of the human frame, and consider the vast number of bones, muscles, veins, arteries, lacteals, lymphatics, and other parts, all curiously combined, and calculated to facilitate every motion of our bodies, and to produce sensitive enjoyment,—along with the organs of sense, the process of respiration, and the circulation of the blood through the whole frame every four minutes,

—can we refrain from adopting the expressive language of the Psalmist? "I will praise thee, for I am fearfully and wonderfully made! marvellous are thy works. My substance was not hid from thee when I was made in secret, and curiously wrought,"—or variegated like needle-work,—"in my mother's womb.* Thine eyes did see my substance when it was yet imperfect; and in thy book all my members were written, which in continuance were fashioned when as yet there was none of them. How precious are thy thoughts (or, thy wonderful contrivances) concerning me, O God! How great is the sum of them! If I should count them, they are more in number than the sand." To which may be added the words of Job, "Thine hands have made and fashioned me; thou hast clothed me with skin and flesh, and hast fenced me with bones and sinews; and thy visitation preserveth my spirit." —When we contemplate the minute wonders of creation, and are struck with astonishment at the inconceivable smallness of certain animated beings,—how can we more appropriately express our feelings than in the language of Scripture, "He is wonderful in counsel, and excellent in working; his wisdom is unsearchable, his understanding is infinite; marvellous things doth he which we cannot comprehend. There is none like unto thee, O Lord, neither are there any works like unto thy works. Thou art great, and dost wondrous things; thou art God alone."

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* In our translation, the beauty and emphasis of this passage are partly lost. The expression, "curiously wrought," literally translated, signifies "flowered with a needle." The process of the formation of the human body in the womb is compared to that in a piece of delicate work wrought with a fine needle, or fashioned with peculiar art in the loom; which, with all its beautiful proportion of figure and variety of colouring, rises by degrees to perfection under the hand of the artist, from a rude mass of silk or other materials, and according to a pattern lying before him. In accordance with this idea, the Divine Being is here represented as working a shapeless mass, after a plan delineated in his book, into the most curious texture of muscles, bones, veins, ligaments, membranes, lymphatics, &c. most skilfully interwoven and connected with each other, till it becomes a structure with all the parts, lineaments, and functions of a man,—no one of which is to be seen at first, any more than the figures in a ball of silk, before it is fashioned with the needle. The wonders of this workmanship are farther enhanced from the consideration, that, while human artificers require the clearest light for accomplishing their work, the Divine Artist performs it "*in secret*," within the dark and narrow recess of the womb. The expression, "How precious are thy *thoughts to me*," should be rendered, "How precious are thy *contrivances respecting me*," namely, in reference to the exquisite structure and organization of the corporeal frame, on which the Psalmist had fixed his meditations.

When we contemplate the amazing structure of the heavens—the magnitude of the bodies which compose the planetary system, and the numerous orbs which adorn the nocturnal sky—when we penetrate with the telescope into the more distant regions of space, and behold ten thousand times ten thousand more of these bright luminaries rising to view from every region of the firmament—when we consider that each of these twinkling luminaries is a sun, equal or superior to our own in size and in splendour, and surrounded with a system of revolving worlds—when we reflect, that all this vast assemblage of suns and worlds, forms, in all probability, but a very small portion of Jehovah's empire, and when our minds are bewildered and astonished at the incomprehensible grandeur of the scene—where shall we find language to express our emotions more energetic and appropriate than in such passages as these? "Canst thou by searching find out God? Canst thou find out the Almighty to perfection? He is glorious in power, his understanding is infinite, his greatness is unsearchable. The heavens declare the glory of Jehovah, and the firmament showeth his handy-work. All nations before him are as nothing, and they are counted to him as less than nothing and vanity. He meteth out the heavens with a span, and comprehendeth the dust of the earth in a measure. Behold! the heaven and the heaven of heavens cannot contain him. By the word of the Lord were the heavens made, and all the host of them by the spirit of his mouth. He spake and it was done; he commanded, and it stood fast. He doth great things past finding out, and wonders without number. Great and marvellous are thy works, Lord God Almighty! Touching the Almighty we cannot find him out; he is excellent in power, and his glory is above the earth and the heavens. Who can utter the mighty operations of Jehovah? Who can show forth all his praise?"

Are we led, from the discoveries of modern astronomy, to infer, that numerous worlds besides our own exist throughout the universe? This idea will be found imbodied in numerous passages of Scripture, such as the following:—"Through faith we understand that *the worlds were framed* by the word of God." "In these last days he hath spoken to us by his Son, whom he hath appointed heir of all things, by whom also he made the worlds." "Thou hast made heaven, the heaven of heavens, *with all their host*, and thou preservest them all, and *the host of heaven worshippeth thee*." "He sitteth upon the circle of the earth, and the inhabitants thereof are as grasshoppers. All the inhabitants of the earth *are reputed as nothing in his sight*. The nations are as the drop of a bucket; and he doth according to his will *in the armies of heaven*, and among the inhabitants of the earth." "He hath prepared his *throne* in the heavens, and *his kingdom ruleth over all*." "When I consider thy heavens—what is man, that thou art mindful of him?" It would be easy to show, were it expedient in the present case, that all such expressions and representations, imbody in them the idea of *a plurality of worlds*, without which they would appear either inexplicable, or as a species of bombast, unworthy of the character of inspired writers. So that, to whatever department of nature we direct our contemplations, we perceive its correspondence with the sentiments expressed in the sacred writings, and find in these writings the most sublime and appropriate language in which to express those emotions which the diversified scenes of the material world are calculated to inspire.

We may now ask, if such an assertion can be made, in truth, with regard to any other writings, ancient or modern, whose sentiments have not been derived from the sacred oracles? Can we find in the writings of all the poets, philosophers, and orators of Greece and Rome, sentiments so dignified, appropriate, and sublime, in relation to the objects to which we have alluded? Do not such writers frequently misrepresent and even caricature the system of nature? Are not their descriptions of the gods, and the actions they attribute to them, in many instances, mean, ridiculous, unworthy of the character of superior beings, and even in the highest degree immoral and profane? And, if we turn to the literature and the sacred books of the Chinese, the Persians, the Hindoos or the Japanese, shall we find any thing superior? And is not the circumstance to which we have adverted, a strong presumptive evidence that the Scriptures of the Old and New Testament were written under the inspiration of the Almighty; and consequently, that they are "profitable for doctrine, for reproof, and for instruction in righteousness, that the man of God may be made perfect, and thoroughly furnished unto all good works?"

Such is a brief view of some of the advantages which may be derived from history and general science in the study of the Scriptures. There is, indeed, scarcely a branch of useful knowledge, of whatever description, but may be rendered in some way or another subservient to the elucidation of the sacred oracles, and in enabling us to take a wide and comprehensive view of the facts and doctrines they declare. Were the great body of mankind, therefore, instructed in general knowledge, and accustomed to rational investigations, they would be enabled to study the Scriptures with much greater interest and intelligence than they can now be supposed to do. They would perceive the beauty and sublimity of their language, the dignity and excellence of the sentiments they contain, the purity of their doctrines, and the beneficent tendency of their moral precepts; and, by familiarizing their minds with the numerous and multifarious facts they exhibit, and comparing them with the history of nations, and with passing events, they would gradually acquire an enlightened and comprehensive view of God's superintending providence. The study of the Scriptures, in their native simplicity, with the helps now alluded to, and without the intermixture of the technical language of theologians, and of party opinions, would be of vast importance in religion. It would convince the unbiased inquirer how little foundation there is in the Scriptures themselves for many of those numerous disputes about metaphysical dogmas, which have rent the Christian world into a number of shreds and patches, and produced jealousy and animosity, where love and affection should have appeared predominant. He would soon be enabled to perceive, that the system of Revelation chiefly consists of a series of important *facts*, connected with the dispensations of God towards our race, and interwoven with a variety of practical and interesting truths; and that the grand design of the whole is to counteract the effects of moral evil, to display the true character of Deity, to promote love to God and man, to inculcate the practice of every heavenly virtue, and to form mankind into one harmonious and affectionate society. He would find none of the technical terms and phraseology which the schoolmen and others have introduced into their systems of theology; nor any of those anathemas, which one sectary has so frequently levelled at another, applied to any one, excepting to those "who love not our Lord Jesus in sincerity." He would naturally be led to the conclusion, that what is not clearly and explicitly stated in the Scriptures, or but obscurely hinted at, in reference to the external government of the church or any other subject, cannot be a matter of primary importance, and consequently, ought never to be the subject of virulent dispute, or the cause of dissension or separation among Christians—and that those things only are to be considered as the prominent and distinguishing truths of religion which are the most frequently reiterated, and expressed with such emphasis and perspicuity, that "he who runs may read them."

Again, such an intelligent study of the Scriptures as would accompany the acquisition of general knowledge, would have a tendency to promote the union of the Christian church. Ignorance and distorted views of the truths of revelation are almost uniformly accompanied with illiberality and self-conceit; and where these prevail, silly prejudices are fostered, and party opinions tenaciously adhered to, and magnified into undue importance. But an enlightened mind,—the farther it advances in the path of knowledge and in the study of the Sacred Oracles, the more will it perceive the limited nature of its faculties, and the difficulty of deciding on certain mysterious doctrines; and consequently, the more will it be disposed to grant to every other mind a liberty of thought on subordinate religious subjects, and to make every allowance for those educational prejudices and other causes which have a tendency to warp the mind to certain favourite opinions. And, when such a disposition more generally prevails, and is accompanied with the exercise of Christian love and moderation—the spirit of party will be gradually undermined, and all who recognise the grand and essential features of genuine Christianity will unite in one lovely and harmonious society. But so long as ignorance and habits of mental inactivity prevail among the great body of the population, such a happy consummation cannot be expected.*

In short, were the Sacred writings studied with reverence and attention, and those departments of knowledge to which I have alluded brought forward to assist in their investigation, Infidelity would soon feel ashamed of its ignorance and impertinence, and hide its head in retirement and obscurity. It is owing, in a great measure, to ignorance of the Scriptures, that so many avowed infidels are to be found in society. "They speak evil of the things which they know not;" "their mouth speaketh great swelling words" of vanity against truths which they never investigated, and which, of course, they do not understand. Even some of those who have attempted to *write* against revelation are not ashamed to avow, that they have never either read or studied the writings it contains. Paine, one of the most virulent adversaries of Christianity, had the effrontery to affirm, that, when he wrote the first part of his "Age of Reason," he was without a Bible. "Afterward," he tells us, in schoolboy language, "I procured a *Bible* and a *Testament*." Who but an arrant fool would have made such a declaration, and thus have proclaimed his own impertinence and folly? and who would have listened with patience to such an impudent avowal, had it been made in relation to any other subject? For, to attempt to answer a book which one had not read, is surely the height of presumption and impudence, and plainly indicates, that the mind was previously prejudiced against it, and determined to oppose its sentiments. Others have looked into the Bible, and skimmed over its contents, with the express purpose of finding faults and contradictions. Emerson, the mathematician, having imbibed a disrelish for the Scriptures, endeavoured to satisfy his mind that they were not divine, by picking out a number of insulated passages, which he conceived to be contradictions, and set them, one opposite to another, in two separate columns, and then was bold enough to aver that he had proved the Bible to be an imposture. Is it any wonder that men who presume to act in this manner should never come to the knowledge of the truth? What book in the world would stand such an ordeal? There is no treatise on any subject whatever, which, if treated in this manner, might not be made to appear a mass of absurdities and contradictions. If the Bible is to be read at all, it must be perused both with reverence and with intelligence; and there is no one who enters on the study of it, in such a state of mind, but will soon perceive that it contains "the witness in itself," that it is from God, and will feel that it is "quick and powerful" in its appeals to the conscience, and a "searcher of the thoughts and intents of the heart." But he who reads it either with scorn, with negligence, or with prejudice, needs not wonder if he shall find himself only confirmed in his folly and unbelief. "For a scorner seeketh wisdom, and findeth it not; but knowledge is easy unto him that hath understanding."

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* For a more full illustration of this topic, see Section V.

I have dwelt, at considerable length, on the topic of Christianity, because it is a subject of peculiar interest and importance to every individual. If, in systems of education, and in the means by which mankind at large may be enlightened and improved, the knowledge of religion be overlooked, and its moral requisitions disregarded, more evil than good may be the result of the dissemination of general and scientific knowledge. We have a proof of this in the scenes of anarchy, licentiousness, and horror which succeeded the first French revolution, when revealed religion was publicly discarded, and atheism, infidelity, and fatalism, accompanied with legalized plundering, became "the order of the day." If knowledge is not consecrated to a moral purpose, and prosecuted with a reference to that immortal existence to which we are destined, the utility of its general diffusion might be justly called in question. But, when prosecuted in connexion with the important discoveries of revelation, it has a tendency to raise man to the highest dignity of which his nature is susceptible, and to prepare him for more exalted pursuits and enjoyments in the life to come.

SECTION X.

Miscellaneous Advantages of Knowledge briefly stated.

In this section, I shall briefly advert to several advantages which would flow from a general diffusion of knowledge, not directly included in those which have already been stated.

I. Minds tutored in knowledge and habits of reflection, *would be led to form just estimates of human character and enjoyment.*

The bulk of mankind are apt to form a false estimate of the characters of men, from considering only those adventitious circumstances in which they are placed, and those external trappings with which they are adorned. Wherever wealth and splendour, and high-sounding titles have taken up their residence, the multitude fall down and worship at their shrine. The natural and acquired endowments of the mind are seldom appreciated and respected, unless they are clothed with a dazzling exterior. A man of genius, of virtue, and of piety, is not distinguished from the common herd of mankind, unless he can afford to live in an elegant mansion, to entertain convivial parties, and to mingle with the fashionable and polite. The poor and ignorant peasant looks up with a kind of veneration to my lord and my lady, as if they were a species of superior beings, though, perhaps, with the exception of a few trifling accomplishments, they are scarcely raised above the level of the vulgar whom they despise, in respect to intellectual attainments; and they are often far beneath them in those moral accomplishments which constitute the true glory of man,—being too frequently the slaves of many foolish caprices and unhallowed passions. To pay homage to mere titles, rank, or riches, has a tendency to degrade the human mind, and has been the source of all that vassalage, slavery, and despotism which have prevailed in the world. On the other hand, the man of rank and fashion looks down with a species of disdain, and considers as unworthy of his notice, the man of talent, or the rational inquirer after truth, if he is clad in a homely dress, and possessed of only a small share of wealth; because, forsooth, he is unqualified to accompany him to horse-races, assemblies, masquerades, and other fashionable entertainments. Many an individual of superlative worth and merit has been thus overlooked by his superiors in rank, and even by the great body of his fellow-men, and has passed through the world almost unnoticed and unknown, except by a few minds congenial to his own. For the beauties and excellences of *mind* can only be perceived and appreciated by those whose mental faculties have been, in some degree, enlightened and improved, and who are qualified to estimate the value of a jewel, although its casket may be formed of coarse materials, and besmeared with sand and mud.

The multitude form no less erroneous estimates in regard to human happiness. Having felt little other misery than that which arises from poverty, want, or excessive labour, they are apt to imagine, that where riches abound, and the avenues to every sensitive enjoyment are free and unobstructed, there misery can scarcely gain admittance, and the greatest share of human happiness must be found; that where there is wealth there can be little sorrow, and that those who glide along in splendour and affluence can scarcely be acquainted with the cares and anxieties which press so heavily upon the rest of mankind. Hence the ruling passion, which distinguishes the majority of mankind, to aspire after elevated station and rank, and to accumulate riches, although it should be at the expense of trampling under foot every social duty, and every moral principle, and even at the risk of endangering life itself. Hence, the idle and the vicious are led to imagine, that if they can but lay hold of wealth, whether by fraud, by deceit, or by open violence, they will be able to administer nutriment to those desires which, when gratified, will complete their happiness.

It is evident, that nothing can be supposed more effectual for counteracting such fallacious tendencies of the human mind than the cultivation of reason, the expanding of the intellectual faculties, and the habit of applying the principles of knowledge to the diversified phenomena of human character and conduct. The man whose mind is accustomed to investigation, and to take an extensive range through the regions of science, and who considers his mental powers as the chief characteristic by which he is distinguished in the scale of animal existence, will naturally be guided in his estimates of human character by *moral* and *intellectual* considerations. His eye will easily penetrate through the thin veil of exterior and adventitious accompaniments, and appreciate what alone is worthy of regard in the characters of men, whether they be surrounded by wealth and splendour, or immersed in poverty or obscurity. And with respect to human happiness, a person of this description will easily enter into such a train of reasoning as the following, and feel its force: —That, in respect of wealth, what we cannot reach may very well be forborne; that the inequality of happiness on this account is, for the most part much less than it seems; that the greatness which we admire at a distance, has much fewer advantages and much less splendour, when we are suffered to approach it; that the happiness which we imagine to be found in high life, is much alloyed and diminished by a variety of foolish passions and domestic cares and anxieties, of which we are generally ignorant; and that the apparent infelicity of the lower stations in society is frequently moderated by various moral and domestic comforts, unknown to many of those who occupy the highest ranks of social life. There is a certain portion of external enjoyment without which no man can be happy; and there is a certain portion of wealth to procure this enjoyment which every rank of society ought to possess, and which even the lowest ranks would obtain, were the movements of the social machine properly conducted. But to pursue riches with all the violence of passion, as the chief end of our being, is not only degrading to our intellectual natures, and tends to block up the avenues to tranquil enjoyment, but is fraught with toil and anxiety, and innumerable hazards. "Wealth," says a certain moral writer, "is nothing in itself; it is not useful but when it departs from us; its value is found only in that which it can purchase, which, if we suppose it put to its best use by those that possess it, seems not much to deserve the desire or envy of a wise man. It is certain, that with regard to corporeal enjoyment, money can neither open new avenues to pleasure, nor block up the passages of anguish. Disease and infirmity still continue to torture and enfeeble, perhaps exasperated by luxury, or promoted by softness. With respect to the mind, it has rarely been observed, that wealth contributes much to quicken the discernment, enlarge the capacity, or elevate the imagination; but may, by hiring flattery, or laying diligence asleep, confirm error and harden stupidity."

Such are some of the views and principles by which an enlightened mind will naturally estimate the characters and enjoyments of mankind. Were the great body of the population in every country qualified to enter into such reasonings, and to feel the force of such considerations, it could not fail of being accompanied with many beneficial effects. It would temper that foolish adulation which ignorance and imbecility so frequently offer at the shrine of wealth and splendour; and would undermine those envious and discontented dispositions with which the lower ranks are apt to view the riches and possessions of the great. As moral principle and conduct, associated with intelligence, are the only proper objects of respect in the human character, it would lead persons to form a judgment of the true dignity of man, not by the glitter of affluence, or the splendour of equipage, but by those moral and intellectual qualities and endowments, which, in every station, demand our regard, and which constitute the real glory of the human character. It would tend to counteract the principle of *avarice*, which has produced so many miseries and mischiefs in society, and to promote that *contentment* under the allotments of Divine Providence in which consists the chief part of the happiness of mankind. And while it would counteract the tendency to foolish and immoral pursuits, it would direct to those rational pursuits and enjoyments which are pure and permanent, and congenial to the high dignity and destination of man. In short, were the attention of the higher and influential classes turned away from hounding and horse-racing, masquerades, gambling, and such like frivolous amusements, and directed to the study of useful science, we might expect to behold them patronizing philanthropic and scientific characters in their plans and investigations, and devoting a portion of their wealth to carry forward those improvements by which the comforts of mankind would be increased, and science and art carried nearer to perfection. The twentieth part of that wealth which is too frequently spent in fashionable follies, were it devoted to such purposes, would be of incalculable service to the interests both of humanity and of science.

II. The acquisition of general knowledge *would enable persons to profit by their attendance on public instructions.*

In the present day, lectures on popular philosophy, astronomy, chymistry, geology, and political economy are occasionally delivered in the principal cities and towns of Great Britain; but, out of a population of thirty or forty thousand, it frequently happens, that scarcely thirty or forty individuals can be collected to listen to instructions on such subjects. This, no doubt, is partly owing to the fee demanded for admission, which is sometimes beyond the reach of many intelligent persons in the lower walks of life. But it is chiefly owing to *the want of taste* for such branches of knowledge—to ignorance of the elements of general science—and to unacquaintance with the *terms* which require to be used in the explanation of such subjects, arising from the want of intellectual instruction in early life. Even of the few who generally attend such lectures, there is not perhaps the one-half who can enter with intelligence into the train of reasoning and illustration brought forward by the lecturer, or feel much interest in the discussions, excepting when their eyes are dazzled with some flashy experiment. Hence it follows, that very little knowledge comparatively can be communicated in this way to the population at large, owing to the deficiency of previous instruction,—and that systems of intellectual education, more extensive and efficient than those which have hitherto been in operation, require to be adopted, before the great body of the people can be supposed to profit by attendance on courses of lectures on any department of knowledge.

The same remark will apply, with a few modifications, to the instructions delivered by the teachers of religion. For want of a proper foundation being previously laid, in the exercise of the rational faculty, and the acquisition of general information, comparatively little advantage is derived from the sermons and expository lectures delivered by the ministers of the gospel. Of a thousand individuals which may compose a worshipping assembly where religious instructions are imparted, there are seldom above two hundred (and most frequently much fewer) that can give any intelligent account of the train of thought which has been pursued, or the topics which have been illustrated in the discourses to which they have professed to listen. This may be owing, in many instances, to the dry and abstract method by which certain preachers construct their discourses, and to the want of energy, and the dull and monotonous manner in which they are delivered. But, in the majority of instances, it is obviously owing to habits of *inattention* to subjects of an intellectual nature—to an incapacity for following a train of illustration or reasoning—and to the want of acquaintance with the meaning of many terms which theological instructers find it expedient to use in the construction of their discourses—and such deficiencies are to be ascribed to the mental faculties not having been exercised from infancy in the pursuit of knowledge and in rational investigations.

This deficiency of knowledge and intellectual culture seems to be virtually acknowledged by the ministers of religion; since, in their general discourses, they confine themselves, for the most part, to the elucidation of the *first principles* of religion. Instead of exhibiting a luminous and comprehensive view of the whole scenery of divine revelation, and illustrating its various parts from the history of nations, the system of nature, and the scenes of human life—they generally confine their discussions to a few topics connected with what are termed the fundamental doctrines of the gospel. Instead of "going on to perfection," as the apostle Paul exhorts, by tracing the elements of Christianity in all their bearings on moral conduct and Christian contemplation, and endeavouring to carry forward the mind to the most enlarged views of the perfections of God and the "glory of his kingdom"—they feel themselves under the necessity of recurring again and again to "the first principles of the doctrine of Christ"—feeding their hearers "with milk" instead of "strong meat." And the reason assigned for waiving the consideration of the more sublime topics of natural and revealed religion, and thus limiting the subject of their discussions, is, that their hearers are unqualified to follow them in the arguments and illustrations which behooved to be brought forward on such subjects—that such an attempt would be like speaking to the winds or beating the air, and would infallibly mar their edification.

If this reason be valid (and that it is partly so there can be little doubt), it implies that some glaring deficiency must exist in the mental culture of the great body of professing Christians, and that it ought to be remedied by every proper mean, in order that they may be qualified to advance in the knowledge of the attributes, the works, and the ways of God, and to "go on unto perfection."

It is foretold in the sacred oracles, that "men shall speak of the might of God's terrible acts," that "his saints shall speak *of the glory of his kingdom*, and talk of his *power*, to make known to the sons of men his mighty operations and the glorious majesty of his kingdom." This prediction has never yet been fulfilled in reference to the great body of the Christian church. For, where do we find one out of twenty among the hearers of the Gospel capable of rehearsing the "terrible acts" of God, either in his moral or his physical operations—of tracing the dispensations of his providence towards nations and communities, in a connected series, from the commencement of time, through the successive periods of history—and of comparing the desolations of cities and the ruin of empires with the declarations of ancient prophecy? Where do we find one out of a hundred capable of expatiating on the "power" of Jehovah, and on the most striking displays of this perfection which are exhibited throughout the vast creation? Or where shall we find those who are qualified to display the magnificence of that empire which is "established in the heavens," embracing within its boundaries thousands of suns and ten thousands of worlds—or "to speak," with intelligence, "of the glory of that kingdom which ruleth over all," and thus "to make known to others the mighty operations" carried on by Jehovah, "and the *glorious majesty* of his kingdom?" It is obvious that no such qualification yet exists among the *majority* of members which compose the visible church. And yet the predictions to which we refer *must be realized*, at some period or another, in the history of the divine dispensations. And, is it not desirable that they should, in some degree, be realized in our own times? And, if so, ought we not to exert all our influence and energies in endeavouring to accomplish so important and desirable an object? And, in what manner are our energies in this respect to be exerted, but in concerting and executing, without delay, plans for the universal *intellectual* instruction of mankind? For, without the communication of knowledge to a far greater extent, and much more diversified than what has ever yet been considered necessary for ordinary Christians, we can never expect to behold in the visible church "saints" endowed with such sublime qualifications as those to which we have alluded, or the approach of that auspicious era when "all shall know the Lord," in the highest sense of the expression, "from the least even to the greatest."

To obtain a comprehensive, and as far as possible a *complete* view of the system of revelation in all its parts and bearings, and to be enabled to comply with all its requirements, is both the duty and the interest of every man. But, in order to this attainment, there must be acquired a certain habit of thinking and of meditating. In vain does a person turn over whole volumes, and attempt to peruse catechisms, bodies of divinity, or even the Scriptures themselves,—he can never comprehend the dependencies, connexions, and bearings of divine truth, and the facts they explain and illustrate, unless he acquire a habit of arranging ideas, of laying down principles, and deducing conclusions. But this habit cannot be acquired without a continued series of instructions, especially in the early part of life, accompanied with serious attention and profound application. For want of such prerequisites the great body of Christians do not reap half the benefit they otherwise might from the preaching of the gospel; and, "when for the time they ought to be teachers of others, they have still need that one teach them again, which be the first principles of the oracles of God." "Hence it is," says a celebrated preacher, "that the greatest part of our sermons produce so little fruit, because sermons are, at least they ought to be, connected discourses, in which the principle founds the consequence, and the consequence follows the principle; all which supposes in the hearers a habit of meditation and attention. For the same reason, we are apt to be offended when anybody attempts to draw us out of the sphere of our prejudices, and are not only ignorant, but ignorant from gravity, and derive, I know not what glory from our own stupidity. Hence it is, that a preacher is seldom or never allowed to *soar* in his sermons, to rise into the contemplation of some lofty and rapturous objects, but must always descend to the *first principles* of religion, as if he preached for the first time, or as if his auditors for the first time heard. Hence our preachers seem to lead us into obscure paths, and to lose us in abstract speculations, when they treat of some of the attributes of God, such as his faithfulness, his love of order, his regard for his intelligent creatures. It is owing to this that we are, in some sense, well acquainted with some truths of religion, while we remain entirely ignorant of others. Hence also it is, that some doctrines which are true in themselves, demonstrated in our Scriptures, and essential to religion, become errors, yea, sources of many errors in our mouths, because we consider them only in themselves, and not in connexion with other doctrines, or in the proper places to which they belong in the system of religion."

Were we then, without delay, to set on foot plans of universal instruction, on a rational principle—were the young generation to be universally trained up in rational exercises and habits of reflection, first at infant schools, and afterward at seminaries of a higher order, conducted on the same intellectual principle, and this system of tuition continued to the age of manhood, we should, ere long, behold a wonderful change in the state of society, in the intelligence of the Christian people, and in the illustrations of religion, which would be introduced into the pulpit. We should behold thousands of intelligent worshippers crowding our religious assemblies, with minds prepared for receiving instruction, and eagerly listening to arguments and illustrations in reference to the most sublime and important subjects. We should behold our preachers explaining the first principles of religion with such clearness and energy, that they should seldom need to recur to the subject, "soaring in their sermons," rising into "the contemplation of some lofty and rapturous objects"—displaying the majesty and supremacy of God in the operations of his moral government among the nations, descanting on his glorious attributes, exhibiting his wisdom in the arrangements of nature and the movements of his providence, illustrating his omnipotence and grandeur from the glories of the firmament, and the magnitude of the universe—directing their hearers to the contemplation of the works of his hand as illustrations of the declarations of his word—demonstrating the truth of revelation from its powerful and beneficent effects—enforcing the holy tempers and the duties which religion requires from every rational and scriptural motive—illustrating the effects of moral evil from the history of nations and the miseries in which it has involved individuals and societies—expatiating on schemes of philanthropy for the improvement of mankind, and the conversion of the heathen, and displaying the love and mercy of God towards our race, and the connexions and bearings of the work of redemption, in its relation to the angelic tribes and other beings, and in its glorious and happy consequences on unnumbered multitudes of mankind, throughout the ages of eternity. In such a state of Christian society we should have no dull monotonous preachers, skimming over the surface of an abstract subject, in a twenty minutes' sermon, and leaving their hearers as dull, and lifeless, and uninformed, as they found them ; but all our public services would be conducted with life, and energy, and pathos, and by men of sanctified dispositions and enlightened understandings, "not given to" idleness and "filthy lucre," but having their whole faculties absorbed in the study of the word, the ways, and the works of God. And, in order to expand the minds of the Christian people, and to prepare them for listening with intelligence to such instructions, we should have Courses of Lectures on Natural History, Philosophy, Astronomy, and General History, attended by *thousands* of anxious inquirers, instead of the *tens* which can now be induced to attend on such means of instruction. For knowledge, when it is clearly exhibited, and where a previous desire has been excited for its acquisition, is a source of enjoyment to the human mind in every stage of its progress, from the years of infancy to the latest period of mortal existence.

III. Such a diffusion of knowledge as that to which we have now adverted, *would introduce a spirit of tolerance and moderation, and prevent the recurrence of those persecutions for conscience' sake, which have so much disgraced the world.*

It is a striking and most melancholy fact in the history of man, that the most dreadful sufferings and tortures ever felt by human beings, have been inflicted on account of differences of opinion respecting the dogmas and the ceremonies of religion. Men have been suffered to remain villains, cheats and robbers, deceitful, profligate and profane, to invade the territories of their unoffending neighbours, to burn cities and towns, to lay waste provinces, and slaughter thousands of their fellow-creatures, and to pass with impunity; while, in numerous instances, the most pious, upright, and philanthropic characters have been hurried like criminals to stakes, gibbets, racks, and flames, merely for holding an opinion different from their superiors respecting a doctrine in religion, or the manner in which the Divine Being ought to be worshipped. In the early ages of Christianity, under the emperor Nero, the Christians were wrapped up in the skins of wild beasts, and some of them in this state worried and devoured by dogs; others were crucified, and others dressed in shirts made stiff with wax, fixed to axle trees, and set on fire, and consumed in the gardens at Rome. Such dreadful persecutions continued under the heathen emperors, with a few intervals, to the time of Constantine, a period of more than two hundred and thirty years. It might not be so much to be wondered at that pagans should persecute the followers of Christ; but it was not long before pretended Christians began to persecute one another on account of certain shades of difference in their religious opinions. The persecutions to which the Waldenses and Albigenses were subjected by the popish church, the strangling and burning of supposed heretics, and the tortures inflicted on those suspected of favouring the doctrines of Protestantism by the Spanish Inquisition—a court whose history is written in flames, and in characters of blood,—exhibit a series of diabolical cruelties, the recital of which is enough to make "the ears of every one to tingle," and to make him feel as if he were degraded in belonging to a race of intelligences capable of perpetrating such dreadful enormities.

Even in the British isles such persecutions have raged, and such cruelties have been perpetrated, and that, too, in the name of the benevolent religion of Jesus Christ. In our times, the more appalling and horrific forms which persecution formerly assumed have been set aside by the civil laws of our country, but *its spirit still remains*, and manifests itself in a variety of different shapes. What other name can be given to a power which prevents a numerous and respectable body of men from holding certain civil offices and emoluments, because they do not belong to an established church, and yet *compels* them to contribute to the maintenance of the ministers of that church, although they do not recognise them as their religious instructers! that denies to a dissenter, or his children, the privilege of being interred in what is called consecrated ground, and refuses to allow a bell to be tolled at their funerals?—that, in Scotland, prevents a person, however distinguished for moral qualifications and intellectual acquirements, from being eligible as teacher of a parochial school, if he is not connected with the established church? and in many other ways attempts to *degrade* thousands of individuals on account of their thinking and acting according to the dictates of their consciences? It is true, indeed, that fires, and racks, and tortures, and gibbets, and thumb-screws are no longer applied as punishments for differences of opinion in religion, for the strong hand of the civil law interposes to prevent them. But were no such power interposed, the principle which sanctions such deprivations as those now mentioned, if carried out to all its legitimate consequences, might soon lead to as dreadful persecutions as those which have already entailed indelible disgrace on the race of man.

Such a spirit of intolerance and persecution is directly opposed to every rational principle, to every generous and humane feeling, to every precept of Christianity, and to every disposition inculcated by the religion of Jesus. *It is the height of absurdity to enforce* belief in any doctrine or tenet, by the application of *physical power*, for it never can produce the intended effect; it may harden and render persons more obstinate in their opinions, but it can never convey conviction to the understanding. And if men had not acted like fools and idiots, as well as like demons, such a force, in such cases, would never have been applied. And, as such an attempt is *irrational*, so it is *criminal* in the highest degree, to aim at producing conviction by the application of flames, or by the point of the sword; being at direct variance both with the *precepts* and the *practice* of the Benevolent Founder of our holy religion.

We have, therefore, the strongest reason to conclude, that were the light of science and of Christianity universally diffused, the hydra of persecution would never dare, in any shape, to lift up its heads again in the world. As it was during the dark ages that it raged in its most horrific forms, so the light of intelligence would force it back to the infernal regions whence it arose, as the wild beasts of the forests betake themselves to their dens and thickets at the approach of the rising sun. Wherever reason holds its ascendency in the mind, and the benevolence of Christianity is the great principle of human action, persecution will never be resorted to, either for extirpating error or enforcing belief in any opinions. An enlightened mind will at once perceive, that in punishing erroneous opinions by fines, imprisonment, racks, and flames, *there is no fitness* between the *punishment* and the supposed *crime*. The crime is a mental error, but penal laws have no internal operation on the mind, except to exasperate its feelings against the power that enforces them, and to confirm it more strongly in the opinions it has embraced. Errors of judgment, whether religious or political, can only be overturned by *arguments* and calm reasoning, and all the civil and ecclesiastical despots on earth, with all their edicts, and bulls, and tortures, will never be able to extirpate them in any other way. For the more that force is resorted to to compel belief in any system of opinions, the more will the mind revolt at such an attempt, and the more will it be convinced, that such a system is worthless and untenable, since it requires such irrational measures for its support. It can only tend to produce dissimulation, and to increase the number of hypocrites and deceivers. An enlightened mind will also perceive, that such conduct is no less *irreligious* than it is irrational; for, where persecution begins religion ends. Religion proclaims "peace on earth and good-will to men;" all its doctrines, laws, and ordinances are intended to promote the happiness of mankind, both in "the life that now is and that which is to come." But actions which tend to *injure* men in their persons, liberty, or property, under the pretence of converting them from error, must be directly repugnant to the spirit of that religion which is "pure and peaceable, gentle, and easy to be entreated," and to the character of that benevolent Being whose "tender mercies are over all his works." If our religion *required* for its establishment in the world the infliction of civil pains and penalties on those who oppose it, it would be unworthy of being supported by any rational being; and it is a sure evidence that it is not the genuine religion of the Bible, but error and human inventions, under the mask of Christianity, that are intended to be established, when such means are employed for its propagation and support. It requires very little reflection to perceive, that religion does not consist in mere opinions or ceremonial observances, but in the cultivation and exercise of those heavenly virtues and dispositions which tend to cement the family of mankind in brotherly affection, and to prepare them for the intercourses and employments of the celestial world; and if these are wanting or disregarded, religion becomes a mere inanity, and it is of little consequence what opinions men profess to entertain respecting it.

In short, in an enlightened state of society, men would be disposed to allow the utmost freedom of thought on every subject not inconsistent with the good order of society, and would nevertheless hold the most friendly intercourse with each other. They would clearly discern that the best way to reclaim the vicious, and to convert the erroneous, is, not to rail and to threaten, but to be affable and gentle, to bring forward cogent arguments, and "in meekness to instruct those who oppose themselves to the truth." They would see that many of those opinions and dogmas, in regard to religion, which have created heart-burnings and dissensions, are comparatively of trivial importance,—that the doctrines in which all Christians agree are much more numerous, and of far greater importance, than those about which they differ,—that there are subjects on which the limited faculties of human beings are unable to form any clear or decisive opinions,—that the mind must form its opinions in accordance with the limited or the expansive range of its intellectual vision,—that where its mental view is narrow and confined, its conclusions must be somewhat different from those which are deduced by a mind qualified to take in a more extensive field of vision,—that the philosopher whose mind takes in at a grasp the general system of the world, and the diversified phenomena of the universe, must have ideas and modes of thinking materially different from those of the peasant, whose views are limited chiefly to the confines of his parish, and the objects immediately around him,—that there are few men *wilfully* erroneous, and that ignorance and vice are the principal causes of false and untenable opinions,—that due allowance ought always to be made for educational biases, local prejudices, social influence, and the range of thought to which individuals have been accustomed,—that the exercise of love towards God and man is of infinitely greater importance than mere coincidence in opinion, and that a complete unanimity of opinion on every subject is not to be expected in the present state, perhaps not even in the future world. Were such considerations taken into account (and they would be all recognised in an enlightened state of society), those contentions and animosities which now rankle in the Christian church, and separate the different sectaries, would be laid to rest, persecution in every shape would be held in universal abhorrence, and peace, moderation, and candour would distinguish the friends of religion and all classes of society.

IV.—A universal diffusion of knowledge would *vanquish the antipathies of nations*, and tend to produce *union and harmony among mankind.*

"God hath made of one blood all nations of men, for to dwell on all the face of the earth." But although they are all the offspring of one Almighty Being, and descended from one original human pair, they have hitherto lived, for the most part, in a state of strife and variance, of contention and warfare. The history of the world contains little else than details of the dissensions of nations, the feuds of chieftains, "the tumults of the people," the revolutions of empires, and the scenes of devastation and carnage which have followed in their train. If we go as far back in our researches as the earliest historical records can carry us, we shall find that wars have prevailed, almost without intermission, in every age, in every country, and among every tribe. No sooner has one series of battles terminated than preparations have been made for another; and in such contests magnificent cities have been tumbled into ruins, provinces desolated, kingdoms rent asunder, and thousands of thousands of human beings slaughtered with all the ferocity of infernal demons. It is not beyond the bounds of probability to suppose that, in those scenes of warfare, the eighth part of the human race, in every age, has been destroyed, or a number of mankind amounting to nearly *twenty thousand millions*, which is equal to twenty-five times the number of inhabitants at present existing in the world. And the leaders in such diabolical exploits, so far from repenting of their atrocities, have generally been disposed to glory in their crimes.

Hence the jealousies, the antipathies, and the hatred which have subsisted, and which still subsist, between neighbouring nations. The Turks hate the Greeks, and, as far as in their power, inflict upon them every species of cruelty and injustice. The Chinese hate the Europeans, cheat them if they can, and pride themselves in their fancied superiority over all other nations. The Moors of Africa hate the negroes, plunder their villages, and reduce them to slavery: the King of Dahomy wages almost continual war with neighbouring tribes, and adorns the walls of his palace with the sculls of prisoners taken in battle. The Algerines and the emperors of Morocco live in a state of continual warfare with Christian nations, seize upon their ships, and reduce their crews to slavery. The *Monucaboes*, who inhabit the inland parts of Malacca, live at variance with all around them, and never fail to set fire to the ripening grain in every field that is unprotected and unenclosed. The Arabians are set against every other nation, and roam through their deserts, attacking caravans and travellers of every description. The inhabitants of one part of New-Zealand are almost in a continual state of enmity against those of another, and the natives of almost every island in the Indian and Pacific Oceans, if not engaged in actual contests, are in a state of warlike attitude with regard to each other. Even nations advanced to high degrees of civilization are found indulging the meanest and most unreasonable jealousies and antipathies in relation to one another. The French and the English, whom nature has separated only by a narrow channel of the sea, and who are distinguished above all other nations for their discoveries and improvements in the arts, have, for centuries, fostered a spirit of jealousy and rivalship which has produced political animosities, hatred, wars, and ruin to the financial and commercial interests of both nations. During the wars which succeeded the French revolution, this spirit of hatred and enmity rose to such a pitch, that a large portion of each nation would have, with pleasure, beheld the other hurled with fury into the infernal regions.*

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* During the wars alluded to, a gentleman (conversing with

Is there no prospect, then, that such antipathies shall ever be extirpated, and harmony restored to the distracted nations? Shall the earth be for ever swept with the besom of destruction? Shall war continue its ravages without intermission? Shall hatred still rankle among all nations, and Peace never wave its olive-branch over the world? Are we to sit down in hopeless despair that a union among the nations will ever be effected because wars have continued since the beginning of the world? No: we have no reason to despair of ultimate success when the moral machinery calculated to effectuate the object shall be set in motion. As ignorance is the parent of vice, the nurse of pride, avarice, ambition, and other unhallowed passions, from which wars derive their origin, so, when the strong-holds of ignorance shall be demolished, and the light of intelligence shall shed its influence over the world, and the opposite principles of humility, moderation, and benevolence shall pervade the minds of men, the foundations of the system of warfare will be shaken, and a basis laid for the establishment of universal peace. However long the ravages of war have desolated and convulsed the world, it is announced in the decree of heaven that a period shall arrive "when *wars shall cease unto the ends of the earth;*" and the era when warriors "shall beat their swords into ploughshares, and their spears into pruning-hooks, and learn the art of war no more," is coeval with the period foretold in ancient prophecy, when "the knowledge of the Lord shall cover the earth, and when all shall know him from the least to the greatest."

Knowledge has a tendency to unite the hearts of all who are engaged in its pursuit: it forms a bond of union among its votaries more firm and permanent than that which unites princes and statesmen,—especially if it is conjoined with Christian principles and virtuous dispositions. Congeniality of sentiments and similarity of pursuits gradually weaken

the author on the subject), who was uttering the most virulent invectives against the French, concluded by saying, "After all, I wish no great evil to the French; *I only wish they were all safely landed in heaven,*" plainly intimating that he considered them unworthy to live upon the earth, and that the sooner they were cut off from it, and sent to the other world, so much the better, whether their fate should be to dwell in the shades of Tartarus or the abodes of Elysium.

the force of vulgar prejudices, and tend to demolish those barriers which the jealousies of nations have thrown around each other. True philosophers, whether English, Swedish, Russian, Swiss, German, or Italian, maintain an intimate and affectionate correspondence with each other on every subject of literature and science, notwithstanding the antipathies of their respective nations. During the late long-continued and destructive warfare between the French and English, which was carried on with unprecedented hostility and rancour, the naturalists, mathematicians, astronomers, and chymists of the two countries held the most friendly correspondence in relation to the subjects connected with their respective departments, in so far as the jealousies of their political rulers would permit. In the communications of the French and English philosophers respecting the progress of scientific discovery we find few traces of nationality, and should scarcely be able to learn from such communications that their respective nations were engaged in warfare, unless when they lament the obstructions which interrupted their regular correspondence, and their injurious effects on the interests of science. It is a well-known fact that, during the late war, when political animosities ran so high, the National Institute of France announced prizes for the discussion of scientific questions, and invited the learned in other nations, not even excepting the English, to engage in the competition; and one of our countrymen, Sir Humphrey Davy, actually obtained one of the most valuable and distinguished of these honorary awards.

When knowledge is conjoined with a recognition of the Christian precept, "Thou shalt love thy neighbour as thyself," its possessor will easily be made to enter into such considerations as the following, and to feel their force:—That all men, to whatever nation or tribe they belong, are the children of one Almighty Parent, endowed with the same corporeal organs, the same intellectual powers, and the same lineaments of the Divine image—that they are subject to the same animal and intellectual wants, exposed to the same accidents and calamities, and susceptible of the same pleasures and enjoyments—that they have the same capacities for attaining to higher degrees of knowledge and felicity, and enjoy the same hopes and prospects of a blessed immortality—that God distributes among them all thousands of benefits, embellishing their habitations with the same rural beauties, causing the same sun to enlighten them, the same vital air to make their lungs play, and the same rains and dews to irrigate their ground, and ripen their fields to harvest—that they are all capable of performing noble achievements, heroic exploits, vast enterprises; of displaying illustrious virtues, and of making important discoveries and improvements—that they are all connected together by numerous ties and relations, preparing for each other the bounties of Nature and the productions of art, and conveying them by sea and land from one country to another; one nation furnishing tea, another sugar, another wine, another silk, another cotton, and another distributing its manufactures in both hemispheres of the globe—in short, that they are all under the moral government of the same Omnipotent Being, who "hath made of one blood all nations of men to dwell on the face of all the earth, who hath determined the boundaries of their habitations," who carries them yearly around the centre of light and heat, and who "gives them rain from heaven and fruitful seasons, filling their hearts with food and gladness." How various, then, the ties, how sacred and indissoluble the bonds, which should unite men of all nations! Every man, whether he be a Jew or a Greek, a Barbarian or a Scythian, a Turk or a Frenchman, a German or a Swede, a Hottentot or an Indian, an Englishman or a Chinese, is to be considered as our kinsman and our brother, and, as such, ought to be embraced with benevolence and affection. In whatever region of the globe he resides, whatever customs or manners he adopts, and to whatever religious system he adheres, he is a member of the same family to which we all belong. And shall we feel indifferent to our brethren, shall we indulge resentment and hostility towards them, because they are separated from us by a river, by a channel, by an arm of the sea, by a range of mountains, or by an arbitrary line drawn by the jealousy of despots, or because their government and policy are different from ours? Ought we not, on the contrary, to take a cordial interest in every thing that concerns them—to rejoice in their prosperity, to feel compassion on account of the ravages, desolation, and misery which error and folly, vice and tyranny may have produced among them; and to alleviate, to the utmost of our power, the misfortunes and oppressions under which they groan? Reason, as well as Christianity, spurns at that narrow-minded patriotism which confines its regards to a particular country, and would promote its interests by any means, although it should prove injurious to every other nation. Whatever tends to the general good of the whole human family will ultimately be found conducive to the prosperity and happiness of every particular nation and tribe; while, on the other hand, a selfish and ungenerous conduct towards other communities, and an attempt to injure or degrade them, will seldom fail to deprive us of the benefits we wished to secure, and to expose us to the evils we intended to avert. Such appear in fact to be the principles of God's moral government among the nations, and such the sanctions by which the laws of natural justice are enforced.

Were such sentiments universally recognised and appreciated, the antipathies of nations would speedily be vanquished, and union and harmony prevail among all the kindreds of the earth. And what a multitude of advantages would ensue—what a variety of interesting scenes would be presented—what an immense number of delightful associations would be produced, were such a union effected among mankind! Were men over all the globe living in peace and harmony, every sea would be navigated, every region explored, its scenery described, its productions collected, its botanical peculiarities ascertained, and its geological structure investigated. The geography of the globe would be brought to perfection; its beauties, harmonies, and sublimities displayed, and the useful productions of every clime transported to every country, and cultivated in every land. Science would, of course, be improved, and its boundaries enlarged; new physical facts would be discovered for confirming and illustrating its principles, and a broad foundation laid for carrying it to perfection. While, at present, every traveller in quest of scientific knowledge in foreign lands is limited in his excursions, and even exposed to imminent danger, by the rancour of savage tribes and the jealousy of despotic governments—in such a state of things, every facility would be given to his researches, and all the documents of history, and the treasures of nature and art, laid open to his inspection. He would be conducted, as a friend and brother, through every city and rural scene; the processes of arts and manufactures, the curiosities of nature, and the archives of literature and science, would be laid open to his view; and he would return to his native land loaded with whatever is curious and useful in nature and art, and enriched with new accessions to his treasures of knowledge. The knowledge and arts of one country would thus be quickly transported to another; agricultural, manufacturing, and mechanical improvements would be gradually introduced into every region; barren wastes would be cultivated, forests cut down, marshes drained, cities founded, temples, schools, and academies erected, modes of rapid communication between distant countries established, mutual interchanges of affection promoted, and "the once barren deserts made to rejoice and blossom as the rose."

We should then behold the inhabitants of distant countries arriving on our shores—not with tomahawks, clubs, spears, muskets, and other hostile weapons, but with the symbols of peace and the productions of their respective climes. We should behold the Malayans, the Chinese, the Cambodians, the Burmese, the Persians, and the Japanese, unfurling their banners on our coasts and rivers, unloading their cargoes of tea, coffee, silks, nankeens, embroideries, carpets, pearls, diamonds, and gold and silver ornaments and utensils—traversing our streets and squares in the costume of their respective countries, gazing at our shops and edifices, wondering at our manners and customs, mingling in our assemblies, holding intercourse with our artists and philosophers, attending our scientific lectures and experiments, acquiring a knowledge of our arts and sciences, and returning to their native climes to report to their countrymen the information they had received, and to introduce among them our discoveries and improvements. "We should behold the tawny Indians of Southern Asia forcing their way up its mighty rivers in their leathern canoes, to the extremities of the north, and displaying on the frozen shores of the icy sea the riches of the Ganges; the Laplander covered with warm fur arriving in southern markets, in his sledge drawn by rein-deer, and exposing for sale the sable skins and furs of Siberia; and the copper-coloured American Indian traversing the Antilles, and conveying from isle to isle his gold and emeralds." We should occasionally behold numerous caravans of Arabians, mounted on their dromedaries and camels, and tribes of Tartars, Bedouins, and Moors visiting the civilized countries of Europe, laden with the rarities and riches of their respective countries, admiring the splendour of our cities and public edifices, learning our arts and manufactures, acquiring a knowledge of our literature and sciences, purchasing our commodities, procuring specimens of our philosophical instruments, steam-engines, and mechanical powers—inviting agriculturists, artists, mechanics, teachers, ministers of religion, mathematicians, and philosophers, to settle among them, for the purpose of improving their system of husbandry, rearing cities, towns, and villages, disseminating useful knowledge, and introducing the arts and enjoyments of civilized society—at the same time inviting them to contract marriages with their sisters and daughters, and thus, by new alliances, *to reunite the branches of the human family*, which, though descended from one common parent, have been so long disunited,—and which disunion, national prejudices and antipathies, as well as climate and complexion, have tended to perpetuate. And, while we were thus instrumental in imparting knowledge and improvements to other nations, we ourselves should reap innumerable advantages. Our travellers and navigators, into whatever regions they might wish to penetrate, would feel secure from every hostile attack, and would recognise in every one they met a friend and a brother, ready to relieve their necessities, to contribute to their comfort, and to direct them in their mercantile arrangements and scientific researches. Our merchants and manufacturers would find numerous emporiums for their goods, and new openings for commercial enterprise, and would import from other countries new conveniences and comforts for the use of their countrymen at home.

From such friendly intercourses we should learn, more particularly than we have yet done, the *history* of other nations, and the peculiar circumstances in which they have existed, particularly of those tribes which have been considered as moving beyond the range of civilized society. All that we at present know of the history of many foreign nations consists of a few insulated sketches and anecdotes, picked up at random by travellers who passed only a few days or weeks in the countries they describe, who were beheld with suspicion, and were imperfectly acquainted with the languages of the inhabitants. But, from a familiar and confidential intercourse, we should become acquainted with the whole series of their history, so far as it is known, which might not only be curious and interesting in itself, but might throw a light on the records of other nations, on the facts of sacred history, and on the general history of the world. We might thus know something of the circumstances which attended the early *dispersion* of mankind,—the motives which determined each tribe to choose its separate habitation in an unknown region, and which induced them to cross unknown arms of the sea, to traverse mountains which presented no path, and rivers which had not yet received a name, and whose commencement and termination were alike unknown. The information which distant tribes refuse us, when we approach them like warlike adventurers or ambitious merchants, would be freely communicated, when we mingled with them as friends and benefactors, and especially, after we had been instrumental in meliorating their physical and moral condition, and in communicating to them our improvements.

And, in the name of all that is sacred and benevolent, what should hinder such harmonious and affectionate intercourses between nations from being universally realized? Are we not all brethren of one family? Have we not all one Father? Has not one God created us? Does not the same planet support us, and the same atmosphere surround us? Does not the same sun cheer and enlighten us? Have we not the same physical organization, the same mental powers, and the same immortal destination? And is it not the interest of every individual of the human family that such a friendly intercourse should be established? Are there any *insuperable* obstructions, any *impassable* barriers, any *natural impossibilities*, that prevent such a union among the nations? No,—knowledge, combined with moral principle and true religion, if universally diffused, would speedily effectuate this wonderful transformation. Enlighten the understandings, direct the moral powers of man, extend the knowledge of Christianity through the world, and a broad foundation will be laid for universal improvement, and *universal friendship* among all nations.

But, in order that we may be instrumental in preparing the way for so desirable an event, our conduct towards other nations, and particularly towards uncivilized tribes, must be very different from what it has generally been in the ages that are past. We must become, not the plunderers and destroyers, but the instructers and the benefactors of mankind. Instead of sending forth the artillery of war, for the subjugation of distant nations, we must uniformly display the banner of love and the branch of peace; instead of despatching crowds of needy adventurers, fired with the cursed love of gold, to plunder and to kill, like the Spaniards in their conquest of Mexico and Peru,—we must send forth armies of enlightened benefactors, to traverse the benighted nations, to carry the knowledge of divine truth within the region of pagan darkness, to impart to them the blessings of instruction, and the comforts and conveniences of civilized life. Instead of landing on their shores swords and spears and musketry,—ploughshares, pruning-hooks, and every other agricultural implement must be plentifully supplied to all the inhabitants. Instead of carrying into slavery their children and relatives, and imbittering their lives with cruel treatment, like the Spaniards and the Portuguese, in reference to the African negroes, we must proclaim "liberty to the captives, and the opening of the prison-doors to them that are bound." In short, our conduct must be almost diametrically opposite to that which political intriguers have generally pursued towards other states, if we would promote union among the nations. Our selfishness must be changed into beneficence, our pride into humility, our avarice into generosity, and our malignity into kindness and benevolence. Kindness and benevolent attentions will sometimes subdue even the most ferocious animals, and will seldom fail to soften the breasts of the most savage people, and to win their affections. There is scarcely an individual within the range of the human species, or even within the range of animated nature, but is susceptible of the impressions of love; and if such principles and affections were to direct the future intercourses of nations, we might expect, ere long, to behold the commencement of that happy era when "the wilderness and solitary place shall be glad, when nation shall no longer lift up sword against nation, when righteousness and praise shall spring forth before all the nations, and when there shall be nothing to hurt or destroy" among all the families of the earth.

V.—A general diffusion of knowledge would be one general means of promoting *union in the Christian Church.*

It is a lamentable fact, that throughout the whole world, there is no system of religion the votaries of which are subdivided into so many sects as those who profess an adherence to the Christian faith. Within the limits of Great Britain there are perhaps not much fewer than a hundred different denominations of Christians belonging to the Protestant church. We have Calvinists, Arminians, Baxterians, Antinomians, Arians, and Unitarians, Episcopalians, Presbyterians, Methodists, Baptists, and Independents,—Seceders, Brownists, Sandemanians, Quakers, Moravians, Swedenborgians, Millenarians, Sabbatarians, Universalists, Sublapsarians, Supralapsarians, Dunkers, Kilhamites, Shakers, &c. Of some of these there are several subdivisions. Thus, there are three or four denominations of Seceders, four or five of Baptists, three or four of Methodists, and two or three of Glassites or Sandemanians. Most of these denominations recognise the leading truths of divine revelation,—the natural and moral attributes of the Deity,—the fall of man,—the necessity of a Saviour,—the incarnation of Christ,—the indispensable duty of faith in him for the remission of sins,—the necessity of regeneration, and of holiness in principle and practice,—the obligation of the moral law,—the doctrine of a resurrection from the dead, and of a future state of rewards and punishments,—in short, every thing by which Christianity is distinguished from Mohammedanism, pagan idolatry, and all the other systems of religion that prevail in the world. Yet, while agreeing in the leading doctrines of the Christian faith, they continue in a state of separation from each other, as if they had no common bond of union, and, as rival sects, are too frequently in a state of alienation, and even of open hostility. The points in which they differ are frequently so minute as to be incapable of being accurately defined, or rendered palpable to an impartial inquirer. Where the difference is most apparent, it consists chiefly in a diversity of opinion respecting such questions as the following:—Whether the election of man to eternal life be absolute or conditional,—whether Christ died for the sins of the whole world, or only for a limited number,—whether there be a gradation or an equality among the ministers of the Christian church,—whether every particular society of Christians has power to regulate its own affairs, or ought to be in subjection to higher courts of judicature,—whether the ordinance of the Lord's Supper should be received in the posture of sitting or of kneeling,—whether Baptism should be administered to infants or adults, or be performed by dipping or sprinkling, &c. Such are some of the points of dispute which have torn the Christian church into a number of shreds, and produced among the different sectaries mutual jealousies, recriminations, and contentions. When we consider the number and the importance of the leading facts and doctrines in which they all agree, it appears somewhat strange, and even absurd, that they should stand aloof from each other, and even assume a hostile attitude, on account of such comparatively trivial differences of opinion, especially when they all profess to be promoting the same grand object, travelling to the same heavenly country, and expect, ere long, to sit down in harmony in the mansions above. The grand principles of human action, which it is the chief object of revelation to establish, and the precepts of morality, which ought to govern the affections and conduct of every Christian, are recognised by all; and why then should they separate from each other, and remain at variance on account of matters of "doubtful disputation?"

The *evils* which flow from such a divided state of Christian society are numerous, and much to be deplored. A sectarian spirit has burst asunder the bonds of Christian love, and prevented that harmonious and affectionate intercourse among Christians which is one of the chief enjoyments of social religion. It has infused jealousies, fanned the flame of animosity and discord, set friends, brethren, and families at variance, and shattered even civil communities into factions and parties. It has kindled contentions and heart-burnings, produced envyings, animosities, and hatred of brethren, burst asunder the strongest ties of natural affection, and has led professed Christians to violate the plainest dictates of humanity and of natural justice. It has excited a feverish zeal for the peculiarities of a sect, while the distinguishing features of Christianity have either been overlooked or trampled under foot. It has wasted money unnecessarily in erecting separate places of worship, which might have been devoted to the promotion of the interests of our common Christianity. It has even corrupted our very *prayers*, infused into them human passions, and a spirit of party, and confined them to the narrow limits of our own sect, as if the Omnipotent, whom we profess to adore, were biased by the same prejudices as ourselves, and dispensed his favours according to our contracted views. Could we fly with the swiftness of an angelic messenger through the various assemblies convened on the Christian Sabbath, while they are offering up their prayers to heaven, what a repulsive and discordant scene would present itself, when we beheld the leaders of certain sects confining their petitions to their own votaries, imploring a *special* blessing upon themselves, as if they were the chief favourites of heaven, lamenting the errors of others, throwing out innuendoes against rival sects, taking credit to themselves as the chief depositaries of gospel truth, and thanking God for their superior attainments in Christian perfection! How unlike the noble, benevolent, and expansive spirit which Christianity inculcates!—Nay, the intolerance which the divisions of the Christian church have engendered has established Inquisitions for the purpose of torturing and burning supposed heretics,—has banished, imprisoned, plundered, hanged, and committed to the flames, thousands and ten thousands, on account of their religious *opinions;* and many eminent characters, illustrious for piety and virtue, have fallen victims to such unchristian barbarities.

In particular, the divisions and contentions of Christians have been one of the chief causes of *the progress of infidelity*. The truth and excellence of our religion can only be exhibited to the world by its effects. And when, instead of love, union, and harmony among its professors, we behold bitter envyings, schisms, contentions, and animosities, there appears nothing to allure vicious and unthinking minds to examine its evidences, and to give it an impartial hearing. "First agree among yourselves," infidels reply, "and then we will consider the truth and importance of your opinions." Such a mode of reasoning and conduct is indeed both absurd and unfair, when the genuine doctrines and requisitions of Christianity are clearly stated in its original records, and which they ought to examine for themselves; but it is a circumstance much to be deplored, that Christians, by their sectarian animosities, should throw a stumbling-block in the way of rational investigation into the truths and foundations of religion, and cause thousands to stumble and fall to their destruction. But what is perhaps worst of all, it has greatly retarded, and still retards, the universal propagation of Christianity through the world. Something has indeed been effected, of late years, by various sections of the Christian church, in the different missionary enterprises which they have conducted, in their separate capacities; but it is not too much to affirm, that, had they acted in combination and in harmony, in the missionary cause, ten times more good would have been effected than has ever yet been accomplished. Besides, in our present mode of propagating the gospel among the heathen, we are, to a certain extent, sowing the seeds of those unhappy dissensions which have so long prevailed among ourselves. And, therefore, till the different religious denominations in this and other Christian lands be brought into a more general and harmonious union, we cannot expect to behold a rapid and extensive propagation of primitive Christianity throughout the pagan world.

Such are some of the evils which a sectarian spirit has produced in the Christian Church. It is almost needless to say that they do not originate in the genius of the gospel, which is directly opposed to such a spirit, but in the corruption of human nature, and the perversion of true religion. They have their rise in *ignorance*,—in ignorance both of the revelations of the Bible, considered as one whole, and of those truths of history, philosophy, and general science which have a tendency to liberalize and to enlarge the capacity of the human mind. This ignorance naturally leads to *self-conceit*, and an obstinate attachment to preconceived opinions and party prejudices, to attaching an undue importance to certain subordinate and favourite opinions, and overlooking the grand essentials of the Christian scheme; and thus prevents the mind from expanding its views, and taking a luminous and comprehensive survey of the general bearings and distinguishing features of the religion of the Bible. And if such numerous and serious evils have followed from the divisions of Christians, it becomes an important inquiry, whether they have ever been productive of advantages sufficient to counterbalance such pernicious effects. Is an obscure question, in relation to church-government, to be set in competition with Christian union? Is a metaphysical opinion about the sovereignty of God, and his counsels during eternity past, to be obstinately maintained, although the strongest bonds of Christian love should thereby be burst asunder? Is the rigid adherence to an opinion respecting dipping or sprinkling in baptism, or the maintenance of a dogma in reference to the extent of Christ's redemption, under pretence of bearing a testimony in behalf of Divine truth, to be considered as sufficient to counterbalance the numerous evils which have flowed from a sectarian spirit? Can we suppose, that He whose law is *love*, who hath commanded us to "keep the unity of the Spirit in the bond of peace," and who hath declared, again and again, in the most explicit terms, "By this shall all men know that ye are my disciples, if ye love one another;" are we to suppose that *He* will consider the maintenance of such opinions, under such pretences, as a warrant for the infringement of the law of charity, or the breach of Christian union, or that he sets a higher value on intellectual subtleties and speculative opinions, than on the practical requisitions of his Word, and the manifestations of Christian temper and conduct? To answer these questions in the affirmative would be little short of offering an insult to the King of Zion. Whatever is not so clearly revealed in Scripture that every rational and serious inquirer does not plainly perceive it to be truth or duty, can scarcely be supposed to be of such importance as to warrant the breach of the unity of the church. For the inspired writers, who were the vehicles of a revelation from heaven, can never be supposed to have used vague or ambiguous language in explaining and enforcing matters of the first importance.

If we consider the temper and conduct of many of those who are sticklers upon phrases, and zealous about matters of mere form, we shall be convinced how few beneficial practical effects are the result of a narrow sectarian spirit. While they appear fired with a holy zeal lest the purity of divine ordinances should be tainted by unwashed hands, you will sometimes find them immersed in the grossest sensualities and immoralities of conduct. While they are severe sticklers for what they conceive to be the primitive form and order of a Christian church, you will not unfrequently find *disorder* reigning in their families, the instruction of their children and servants neglected, and a sour and boisterous spirit manifested in all their intercourses with their domestics. Yea, you will find, in numerous instances, that they scruple not to practise *frauds* in the course of their business, and that you can have less dependance on their promises than on those of the men of the world, who make no pretences to religion. As an excellent writer has well observed, "An ardent temperament converts the enthusiast into a zealot, who, while he is laborious in winning proselytes, discharges common duties very remissly, and is found to be a more punctilious observer of his creed than of his word. Or, if his imagination is fertile, he becomes a visionary, who lives on better terms with angels and with seraphs, than with his children, servants, and neighbours; *or*, he is one, who, while he reverences the 'thrones, dominions, and powers' of the invisible world, vents his spleen in railing on all 'dignities and powers on earth.'"*

What are the *remedies*, then, which may be applied for healing the unhappy divisions which have arisen in the Christian church? It is evident, in the first place, that we must discard the greater part of those human systems of divinity, and those polemical writings and controversies, which have fanned the flame of animosity, and which have so frequently been substituted in the room of the oracles of God. We must revert to the Scriptures as the sole standard of every religious opinion, and fix our attention chiefly on those matters of paramount importance which are clearly revealed, which are obvious to every attentive reader, and which enter into the essence of the Christian system. For, to maintain that the Scriptures are not sufficiently clear and explicit in regard to every thing that has a bearing on the present comfort and the everlasting happiness of mankind, is nothing short of a libel on the character of the sacred writers, and an indignity offered to Him by whose Spirit they were inspired. We must also endeavour to discard the "vain janglings," the sophistical reasonings, and the metaphysical refinements of the schools, and the technical terms of polemical theology, such as *trinity*, *hypostatical union*, *sacraments*, &c., and, in our discussions, especially on mysterious or doubtful subjects, adhere as nearly as possible to the language of the inspired writers. In particular, more attention ought to be paid to the manifestation of *Christian love*, and the *practice* of religion, than to a mere coincidence of view with regard to certain theological dogmas. For it is easy to conceive, that a man may be animated by holy principles and dispositions, although he may have an obscure conception, or may even entertain an erroneous opinion of some of the doctrines of religion; and we know by experience, that men may contend zealously for what are considered orthodox doctrines, and yet be destitute of the spirit of religion, and trample on its most important practical requirements. And were the *spirit* of our holy religion thoroughly to pervade the different sections of the church—were Christian *affection* more generally manifested among all who bear the Christian name, and the practical injunctions of Christianity uniformly exemplified in their conduct, we should soon behold a general coincidence of opinion on every thing that can be deemed important in religion, and a mutual candour and forbearance, in regard to all subordinate opinions, that do not enter into the essence of religion, and which ought to be left to the private judgment of every inquirer.

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* Natural Hist. of Enthusiasm, p. 14.

But I entertain little hope that such measures will be adopted, and an object so desirable accomplished, while so much ignorance still pervades the minds of the majority of Christians, and while the range of their intellectual views is so much contracted. It is only when the effects of a general diffusion of knowledge shall be more extensively felt, that a more general and cordial union of the Christian world is to be expected. Light in the understanding is the source of all reformations, the detecter of all evils and abuses, the corrector of all errors and misconceptions, and the stimulus to every improvement. It dispels the mists which prevented our distinct vision of the objects of our contemplation, discovers the stumbling-blocks over which we had fallen, points out the devious ways into which we had wandered, and presents before us every object in its just magnitude and proportions. The knowledge to which I allude consists, in the first place, in a clear and comprehensive view of the whole system of divine revelation, in all its connexions and bearings,—and, in the next place, in an acquaintance with all those historical, geographical, and scientific facts which have a tendency to expand the capacity of the mind, and to enlarge our conceptions of the attributes of God, and of the ways of his providence. Wherever the mind is thoroughly enlightened in the knowledge of such subjects, the tendency to bigotry and sectarianism will quickly be destroyed, and the partition walls which now separate the different sections of the church will gradually be undermined and crumble into dust. This might be illustrated from the very nature of the thing. A man whose mind is shrouded in comparative ignorance is like a person who lands on an unknown country in the dusk of the evening, and forms his opinion of its scenery and inhabitants from the obscure and limited view he is obliged to take of them during the course of a few hours,—while he whose mind is enlightened in every department of human and divine knowledge, is like one who has taken a minute and comprehensive survey of the same country, traversed its length and breadth, mingled with every class of its inhabitants, visited its cities, towns, and villages, and studied its arts and sciences, its laws, customs, and antiquities. The one can form but a very imperfect and inaccurate conception of the country he has visited, and could convey only a similar conception to others,—the other has acquired a correct idea of the scene he has surveyed, and can form an accurate judgment of the nature, the tendency, and bearings of the laws, institutions, and political economy which have been the subject of his investigations. So that the accounts given by these two visiters, of the same country, behooved to be materially different. The sectarian bigot is one who has taken a partial and limited view of one or two departments of the field of revelation, who fixes his attention on a few of its minute objects, and who overlooks the sublimity and the grand bearings of its more magnificent scenery. The man of knowledge explores it throughout its length and breadth, fixes his eye upon its distinguishing features, and brings all the information he has acquired from other quarters to assist his conceptions of the nature, the bearings, and relations of the multifarious objects presented to his view. The luminous views he has taken of the leading objects and design of revelation, and the expansive conceptions he has acquired of the perfections of Him by whom it was imparted, will never suffer him to believe that it is agreeable to the will of God that a Christian society should be rent asunder in the spirit of animosity, because one party maintains, for example, that *dipping* is the true mode of performing baptism, and the other, that it should be administered by *sprinkling*, while they both recognise it as a divine ordinance, and symbolical of spiritual blessings,—or that such conduct can have a tendency to promote the glory of God, and the best interests of men. He can never believe that that incomprehensible Being who inhabiteth eternity, who superintends the affairs of ten thousand worlds, and who hath exhibited in his Word the way to eternal life in the clearest light,—should attach so great a degree of importance to such questions, that either the one party or the other should be considered as exclusive supporters of divine truth, while they infringe the law of Christian love, and forbear "to keep the unity of the spirit in the bond of peace." For, in reference to the example now stated, a few drops of water are equally a *symbol* or *emblem* as the mass of liquid in a mighty river; and to consider the Almighty as beholding with approbation such speculations, and their consequent effects, would be little short of affixing a libel on his moral character. The man of knowledge is disposed to view in the same light almost all the minute questions and circumstantial opinions, which have been the cause of separating the church of Christ into its numerous compartments.

If we attend to facts, we shall find, that in ninety-nine cases out of a hundred, the man who is a violent party-partisan is one whose ideas run in one narrow track, and who has taken a very limited and partial survey of the great objects of religion. He is generally unacquainted with the range of history, the facts of science, the philosophy of nature, and the physical and moral state of distant nations. His mind never ranges over the globe, nor contemplates the remote wonders of the Creator's empire. His reading is chiefly confined to the volumes and pamphlets published by the partisans of his own sect; he can run over the scriptures and arguments which support his opinions, like a racer in his course, but, if you break in upon his train of thought, and require him to prove his positions as he goes along, he is at a stand, and knows not how to proceed. While he magnifies, with a microscopic eye, the importance of his own peculiar views, he almost overlooks the grand and distinguishing truths of the Bible, in which all true Christians are agreed. On the other hand, there is scarcely one instance out of a hundred, of men whose minds are thoroughly imbued with the truths of science and revelation, being the violent abetters of sectarian opinions, or indulging in party animosities; for, knowledge and liberality of sentiments almost uniformly go hand in hand. While we ought to recognise and appreciate every portion of divine truth, in so far as we perceive its evidence,—it is nevertheless the dictate of an enlightened understanding, that *those truths which are of the first importance demand our first and chief attention.* Every controversy agitated among Christians on subjects of inferior importance, has a direct tendency to withdraw the attention from the great objects which distinguish the revelations of the Bible; and there cannot be a more absurd or fatal delusion, than to acquire correct notions on matters comparatively unimportant, while we throw into the shade, or but faintly apprehend, those truths which are essential to religion, and of everlasting moment. Every enlightened Christian perceives the truth and importance of this position; and were it to be universally acted upon, sectarian divisions and contentions would soon cease to exist; for they have almost uniformly taken place in consequence of attaching too great a degree of importance to matters of inferior moment.

Were the minds of the members of the Christian church, therefore, thoroughly enlightened, and imbued with the moral principles of the religion of Jesus, we should soon behold, among all denominations, a tendency to union, on the broad basis of recognising the grand essential truths of Christianity, which formed the principal subjects of discussion in the sermons of our Saviour and his apostles—and a spirit of forbearance manifested in regard to all opinions on matters of inferior importance. Were this period arrived—and, from the signs of our times, its approach cannot be very distant—it would be attended with a train of the most glorious and auspicious effects. A merging of party differences, and a consequent union of enlightened Christians, would dissipate that spirit of trifling in religion by which so much time has been absorbed in discussing sectarian opinions, to the neglect of the great objects of the Christian faith; for when trivial controversies are quashed, the time and attention they absorbed would be devoted to more sublime and important investigations. It would have a powerful influence on the propagation of Christianity throughout the heathen world; for the whole Christian world would then become one grand missionary society, whose operations would be conducted with more efficiency and skill, whose funds would be much more ample, and whose missionaries would be better educated than they now are—and those sectarian differences of opinion, which now produce so many unhappy dissensions, for ever prevented from disturbing the harmony of converts in distant lands. It would cherish the principle of Christian love, detach it from every unholy jealousy, and render it more ardent and expansive in its philanthropic operations. It would produce a powerful and beneficial influence upon the men of the world, and even upon infidels themselves; it would snatch from them one of their most powerful arguments against the religion of the Bible, and would allure them to the investigation of its evidences, by the exhibition it gave of its harmonious and happy effects. It would have an influence on the minds of the Roman Catholics, in leading them to an unbiased inquiry into the grounds on which the Protestant church is established. At present, when called upon to examine the doctrines of Protestantism, they retort upon us—"You are divided into a hundred different sects, and are at variance among yourselves; show us which of these sects is in possession of the truth, and we will then examine your pretensions, and perhaps come over to your standard." It would have an influence on the Jewish people, in removing their prejudices against the religion of Jesus of Nazareth, especially were it followed, as it likely would be, with a repeal of all those statutes which have imposed upon them disabilities, deprived them of the rights of citizenship, and subjected them to unchristian severities. In short—in connexion with the general manifestation of Christian principle—it would produce a benign influence on surrounding nations, and on the world at large. For a body of Christians, in such a country as ours, formed into one grand association, and acting in harmony, must exert a powerful influence on the councils of the nation; and our political intercourses with other states, being conducted on the basis of Christian principles and laws, would invite their attention to a religion productive of so much harmony and so many beneficial effects. Peace and unity in the church would have a tendency to promote peace and friendship among nations; the cause of universal education would be promoted, without those obstructions which now arise from sectarian prejudices; and a general diffusion of useful knowledge would soon be effected throughout every quarter of the civilized world, till the knowledge of Jehovah should cover the earth as the waters cover the channels of the seas.

The disunion of the Christian Church is not to be perpetual. We are certain, that a period is hastening on when its divisions shall be healed, when its boundaries shall be enlarged, and when "*the name of Jehovah shall be one, throughout all the earth.*" At some period or other, therefore, in the lapse of time, a movement towards such a union must commence. It cannot take place before the attention of the religious world is directed to this object. And why should not such a movement commence at the present moment? Why should we lose another year, or even another month, before we attempt to concert measures, in order to bring about a consummation so devoutly to be wished? The present eventful period is peculiarly auspicious for this purpose; when the foundations of tyranny, injustice, and error are beginning to be shaken; when knowledge is making progress among every order of society; when reforms in the state, and in every subordinate department of the community, are loudly demanded by persons of every character and of every rank; when the evils attached to our ecclesiastical institutions are publicly denounced; when the Scriptures are translating into the languages of every tribe; and when missionary enterprises are carrying forward in every quarter of the habitable globe. To attempt a union of all true Christians at the present crisis, would, therefore, be nothing more than falling in with the spirit of the age, and acting in harmony with those multifarious movements which are destined to be the means of enlightening and renovating the human race; and at no period since the Reformation could such an attempt have been made with more sanguine expectations, and greater prospects of success. All eyes are now turned towards some eventful and auspicious era, when the light of science shall shine refulgent, when abuses shall be corrected, evils remedied, society meliorated, and its various ranks brought into more harmonious association. And shall Christians alone remain shut up in their little homesteads, apart from each other, stickling about phrases, and contending about forms, without ever coming forth to salute each other in the spirit of union, and to give an impulse to the moral machinery that is hastening forward the world's improvement and regeneration? Such a surmise cannot be indulged: it would be a libel on the Christian world, and a reproach on the religion of which they profess themselves the votaries. I trust there are thousands in every department of the Church who are ardently longing to break down the walls of partition which separate them from their brethren, and anxiously waiting for an opportunity of expressing their sentiments, and of giving the right hand of fellowship "to all who love our Lord Jesus in sincerity."

In any attempts that may be made to promote this great object, *mutual concessions behoove to be made by all parties.* One general principle, that requires to be recognised, is this: —*that every opinion and practice be set aside which is acknowledged on all hands to have no direct foundation in Scripture*, but is a mere human fabrication, introduced by accident or whim; such as the observance of fast and preparation days previous to the participation of the Lord's Supper, kneeling in the act of partaking of that ordinance, repeating the Athanasian Creed in the regular services of the church, &c. &c. It is a striking and remarkable fact, that the chief points about which Christians are divided are points on which the volume of inspiration is silent, and which the presumption and perversity of men have attached to the Christian system, and interwoven with the truths and ordinances of religion; and, therefore, were the line of distinction clearly drawn between mere human opinions and ceremonials, and the positive dictates of revelation, and the one separated from the other, the way would be prepared for a more intimate and harmonious union in the Church of Christ. As a preparative measure to such a union, a friendly intercourse between the different sects* should be solicited and cherished. Enlightened ministers of different denominations should occasionally exchange pulpits, and officiate for each other in the public exercises of divine worship. This would tend to show to the world, and to each other, that there is no unholy jealousy or hostile animosity subsisting between them, which their present conduct and attitude too frequently indicate. It would also be productive of many conveniences, in the case of a minister being indisposed, or absent from home, as his place could frequently be supplied, without the least expense or inconvenience, by his brethren of other denominations. It would likewise show to the mass of professing Christians, that the doctrines promulgated, and the duties enforced, by ministers of different denominations, are substantially the same. What a disgrace to the Christian name, that such a friendly intercourse has never yet been established; or, when it occasionally happens, that it should be considered as an extraordinary and unlooked-for phenomenon! What a strange and unexpected report must be received by Christian converts in heathen lands, when they are told that Christian ministers in this country, who were instrumental in sending missionaries to communicate to them the knowledge of salvation, are actuated by so much jealousy, and stand so much aloof from each other, that even at the very time they are planning missionary enterprises, they will refuse their pulpits to each other, for the purpose of addressing their fellow-men on subjects connected with their everlasting interests, and refrain from joining in unison in the ordinances of religion, although many of them expect, ere long, to join in harmony in the services of the sanctuary above! It is to be hoped, that such a disgrace to the Christian cause will soon be wiped away, and its inconsistency clearly perceived by all who are intelligent and "right-hearted men."

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* By *sects*, in this place, and elsewhere, I understand, not only the different denominations of *Dissenters*, but the Church of England, the Church of Scotland, and all other national churches, which are all so many sects, or different compartments of the universal Christian Church.

Such a friendly intercourse and correspondence as now suggested would be far more efficient in preparing the way for a cordial union of Christians, than the deliberations and discussions of a thousand doctors of divinity, delegated to meet in councils to settle the points in dispute between the different sects. This object, I presume, will never be accomplished by theological controversy, or by any attempt to convince the respective parties of the futility or erroneousness of their peculiar opinions; but, on the ground of their being brought nearer to each other, and more firmly united in the mutual exercise of the Christian virtues, and in the bonds of Christian affection. And when such an harmonious intercourse shall be fully effected, it will form a more glorious and auspicious era in the history of the Christian Church, than has ever occurred since the "good tidings of great joy" were proclaimed in the plains of Bethlehem, or since the day of Pentecost, when "the whole multitude of them that believed were of one heart, and of one soul, and had all things common."*

SECTION XI.

On the Importance of connecting Science with Religion.

In several of the preceding sections, I have exhibited sketches of the outlines of some of the branches of science, and of the objects towards which its investigations are directed. I have all along taken it for granted that such knowledge and investigations ought to be combined with just views of religion, and an attention to its practical acquirements, and have occasionally interspersed some remarks on this topic. But as the subject is of peculiar importance, it may not be inexpedient to devote a section to its more particular elucidation.

Of late years, knowledge has increased, among the middle and lower ranks of society, with greater rapidity than in any preceding age, and Mechanics' Institutions, and other associations, have been formed, to give an impulse to the renewed vigour of the human mind, and to gratify the desires which are now excited for intellectual pleasures and acquirements. Reason is arousing from the slumber of ages, and appears determined to make aggressions on the world of science, and to employ its faculties on every object which comes within the range of human investigation. The labourer, the mechanic, and artisan,—no longer confined to trudge in the same beaten track in their respective professions, and to the limited range of thought which distinguished their predecessors in former generations—aspire after a knowledge of the principles on which their respective arts are founded, and an acquaintance with those scientific subjects which were formerly confined to the cloisters of colleges and the higher orders of society. Lectures have been delivered in most of our towns, and even villages, on the practice of the arts and the principles of the physical sciences, which have extended their intellectual views, and given them a higher idea of the nobleness and sublimity of the mental faculties with which they are endowed. This excitement to rational inquiry has partly arisen from the spirit of the age, and the political movements which have distinguished our times; but it has also been produced by the exertions of men of erudition, in concerting plans for the diffusion of knowledge, in giving a popular form to works of science, and divesting it of that air of mystery which it formerly assumed. And should such excitement be properly directed, it cannot fail to raise the lower ranks of the community from intellectual degradation, and to prevent them from indulging in intemperance, and other sensual vices, which have so long debased our rational nature. At no former period has the spirit of science been so fully awakened, and so generally disseminated. On every side the boundaries of knowledge have been extended, the system of nature explored, the labours of philosophy withdrawn from hypothetical speculations to the investigation of facts, and the liberal and mechanical arts carried to a pitch of perfection hitherto unattained.

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* See *Appendix*, Note XI.

But amid all the intellectual movements around us, it is matter of deep regret that the knowledge of true religion, and the practice of its moral precepts, have not kept pace with the improvements and the diffusion of science. Not a few of those who have lately entered on the prosecution of scientific pursuits,—because their ideas have been expanded a little beyond the limited range of thought to which they were formerly confined—seem now to regard revealed religion as little else than a vulgar superstition, or, at most, as a matter of inferior moment. Because their forefathers thought that the earth was the largest body in nature, and placed in a quiescent state in the centre of the universe, and that the stars were merely brilliant spangles fixed in the concave of the sky, to diversify the firmament—which notions are now proved to be erroneous—therefore they are apt to surmise that the religion they professed rested on no better a foundation. Because their notions of that religion were blended with erroneous opinions and foolish superstitions, they would be disposed to throw aside the whole, as unworthy of the attention of men of enlightened understandings, whose minds have been emancipated from the shackles of vulgar prejudice and priestly domination. Such irreligious propensities have their origin, for the most part, in a principle of *vanity* and *self-conceit*, in that spirit of *pride* congenial to human nature, which leads the person in whom it predominates to vaunt himself on his superiority to vulgar opinions and fears—and in the want of discriminating between what is of essential importance in religion, and the false and distorted notions which have been incorporated with it by the ignorance and perversity of men.

This tendency to irreligion has likewise been promoted by the modes in which scientific knowledge has been generally communicated. In the greater part of the best elementary treatises on science, there seldom occurs any distinct reference to the perfections and the agency of that Omnipotent Being under whose superintendence all the processes of nature are conducted. Instead of directing the young and untutored mind to rise "from nature up to nature's God"—it is considered by many as *unphilosophical*, when explaining natural phenomena, to advert to any but proximate causes, which reason or the senses can ascertain; and thus a veil is attempted to be drawn between the Deity and his visible operations, so as to conceal the agency of Him whose laws heaven and earth obey. In the academical prelections on physical science, in most of our colleges and universities, there appears a studied anxiety to avoid every reflection that wears the semblance of religion. From the first announcement of the properties of matter and the laws of motion, through all their combinations in the system of nature, and their applications to dynamics, hydrostatics, pneumatics, optics, electricity, and magnetism, the attention of the student is kept constantly fixed on secondary causes and physical laws, as if the universe were a self-existent and independent piece of mechanism; and it is seldom that the least reference is made to that Almighty Being who brought it into existence, and whose laws and operations are the subject of investigation. It is almost needless to add, that the harmony which subsists between the works of God and the revelations of his Word—the mutual light which they reflect upon each other—the views which they open of the plan of the Divine government—and the moral effects which the contemplation of nature ought to produce upon the heart—are never, so far as we have learned, introduced, in such seminaries, as subjects which demand particular attention. Thus the Deity is carefully kept out of view, and banished, as it were, from his own creation; and the susceptible mind of the youthful student prevented from feeling those impressions of awe and reverence, of love and gratitude, which the study of the material world, when properly conducted, is calculated to produce.

The same principles and defects are perceptible in the instructions communicated in most of the *Mechanics' Institutions*, which have been lately formed for the improvement of the middle and lower classes of society. It has been publicly announced, in the speeches of gentlemen of science and erudition, who, with a laudable zeal, took a part in the organization of these institutions,—and the announcement has been re-echoed in every similar association, and transcribed into every literary journal,—that, "*Henceforward the discussions of science are to be completely separated from religion.*" I do not mean to accuse the highly respectable characters alluded to as being hostile either to natural or revealed religion, from the circumstance of their having made this announcement; as I presume they only intended by it to get rid of those sectarian disputes about unimportant points in theology which have so long disturbed the peace of the church and of the world. But when I consider the use that will be made of it by certain characters and societies, and the bearing it may have on the mode of communicating scientific knowledge, I am constrained to pronounce the declaration as no less *unphilosophical* than it is impious and immoral in its general tendency. It is *unphilosophical;* for science, when properly considered in relation to its higher and ultimate objects, is nothing else than an investigation of the power, wisdom, benevolence, and superintending providence of the Almighty, as displayed in the structure and movements of the universe,—of the relation in which we stand to this Great Being,—and of the duties which we owe him. To overlook such objects is evidently contrary to the plainest dictates of reason and philosophy. Is it possible that an intelligent mind can contemplate the admirable and astonishing displays of divine perfection and munificence, throughout every part of creation, and not be excited to the exercise of love, and gratitude, and reverential adoration? Such feelings and emotions lie at the foundation of all true religion,—and the man who can walk through the magnificent scene of the universe without feeling the least emotion of reverence and adoration, or of gratitude for the wise and benevolent arrangements of nature, may be pronounced unworthy of enjoying the beneficence of his Creator. It was doubtless for this end, among others, that the Almighty opened to our view such a magnificent spectacle as the universe displays, and bestowed upon us faculties capable of investigating its structure,—that we might acquire, from the contemplation of it, enlarged conceptions of the attributes of his nature, and the arrangements of his providence, and be excited to "give unto him the glory due to his name." And if we derive such impressions from our investigations of the material system, shall it be considered as inconsistent with the spirit of true philosophy to endeavour to communicate the same impressions to the minds of those whom we are appointed to instruct? There can be little doubt, that the practice of setting aside all references to the character and perfections of the Deity in physical discussions has tended to foster a spirit of irreligion in youthful minds, and to accelerate their progress towards the gulf of infidelity and skepticism.

Again, philosophy, as well as religion, requires that the phenomena of nature be traced up to their *first cause.* There are no causes cognizable by the senses which will account for the origin of the universe, and the multifarious phenomena it exhibits; and therefore we must ascend in our investigations to the existence of an invisible and eternal Cause, altogether impalpable to the organs of sense, in order to account for the existence and movements of the material world. To attempt to account for the harmony and order, and the nice adaptations which appear throughout creation, merely from the physical properties of matter and the laws of motion, is to act on the principles of atheism; and is clearly repugnant to every dictate of reason, which declares, that to every effect we must assign an adequate cause. And if in our physical investigations we are *necessarily* led to the admission of a self-existent and eternal Being, the original source of life and motion, it must be deeply interesting to every one of us to acquire as much information as possible respecting his perfections, and the character of his moral government. From Him we derived our existence,—on Him we depend every moment "for life, and breath, and all things." Our happiness or misery is in his hands, and our eternal destiny, whether connected with annihilation or with a state of conscious existence, must be the result of his sovereign and eternal arrangements. Our comfort in the present life, and our hopes and prospects in relation to futurity, are therefore essentially connected with the conceptions we form of the attributes of Him who made and who governs the universe; and, consequently, that philosophy which either overlooks or discards such views and considerations is unworthy of the name,—is inconsistent with the plainest deductions of reason, and wherever it is promulgated must prove inimical to the best interests of mankind. To regard science merely in its applications to the arts of life, and to overlook its deductions in reference to the Supreme Disposer of events, is *preposterous* and absurd, and unworthy of the character of the man who assumes to himself the name of a philosopher; for, in doing so, he violates the rules which guide him in all his other researches, and acts inconsistently with the maxim, that the most interesting and important objects demand our first and chief attention.

But the evil to which I have now adverted is not the only one of which we have reason to complain. While the deductions of natural religion are but slightly adverted to in physical discussions, and in many instances altogether overlooked,—*the truths of Christianity are virtually set aside;* and it seems to be considered by some as inconsistent with the dignity of science, to make the slightest reference to the declarations of the sacred oracles. In many of our grammar schools, academies, and colleges, where the foolish and immoral rites of pagan mythology are often detailed, no instructions are imparted to counteract the baneful influence which heathen maxims and idolatry may produce on the youthful mind. The superior excellence of the Christian religion, and the tendency of its principles and precepts to produce happiness, both here and hereafter, are seldom exhibited; and in too many instances the recognition of a Supreme Being, and of our continual dependence upon him, and the duty of imploring his direction and assistance, are set aside, as inconsistent with the spirit of the age, and with the mode of conducting a fashionable education. The superintendents of mechanics' institutions, following the prevailing mode, have likewise agreed to banish from their institutions and discussions all references to religion, and to the peculiarities of the Christian system.

Now, we maintain that Christianity, in every point of view in which its revelations may be considered, is *a subject of paramount importance.* It is every thing, or it is nothing. It must reign supreme over every human pursuit, over every department of science, over every passion and affection, or be discarded altogether, as to its authority over man. It will admit of no compromises; for the authority with which it professes to be invested is nothing less than the will of the Eternal, whose sovereign injunctions the inhabitants of earth and the hosts of heaven are bound to obey. If its claims to a divine origin can be disproved, then it may be set aside as unworthy of our regard, and ranked along with the other religions which have prevailed in the world. But, *if it is admitted to be a revelation from the Creator of the universe to man on earth,* its claims are irresistible, it cannot be rejected with impunity, and its divine principles and maxims ought to be interwoven with all our pursuits and associations.

The importance of Christianity may be evinced by such considerations as the following: It communicates to us the only certain information we possess of the character, attributes, and purposes of the Creator, to whose laws and moral government we are all amenable. It discloses to us our state and condition, as depraved creatures and violators of his righteous laws, and the doom which awaits the finally impenitent in the world to come. It informs us of the only method by which we may obtain forgiveness of sin, and complete deliverance from all the miseries and moral evils to which we are exposed. It inculcates those divine principles and moral precepts which are calculated to unite the whole human race in one harmonious and affectionate society, and to promote the happiness of every individual, both in "the life that now is and in that which is to come." It presents before us sources of consolation, to cheer and support the mind amid the calamities and afflictions to which we are subjected in this mortal state. It unfolds to us, in part, the plan of God's moral government of the world, and the reasons of certain dispensations and moral phenomena, which would otherwise have remained inexplicable. In short, it proclaims the doctrine of a resurrection from the dead, and sets in the clearest light the certainty of a future state of punishments and rewards, subjects in which every individual of the human race is deeply interested—giving full assurance to all who comply with its requisitions, that when their corporeal frames are dissolved, they "shall have a building of God, an house not made with hands, eternal in the heavens," where they shall inherit "fulness of joy and pleasures for evermore."

These are only some of the important revelations which Christianity unfolds. And, if it be a truth which cannot be denied, that we are naturally ignorant of God, can we be happy without being acquainted with his moral attributes, purposes, and laws? If we be guilty and depraved—which the whole history of our race clearly demonstrates—can we feel true enjoyment, if our guilt is not cancelled, and our depravity not counteracted? Is it a matter of indifference, whether we acquire a knowledge of those moral principles which will guide us in the path to wisdom and felicity, or be hurried along by heedless passions, in the devious ways of vice and folly? Is it of no importance, whether we obtain information respecting our eternal destiny, or remain in uncertainty whether death shall transport us to another world, or finally terminate our existence? Can any man, who calls himself a philosopher, maintain, with any show of reason, that it is *unphilosophical*, or contrary to the dictates of an enlightened understanding, that such subjects should form one great object of our attention—that they should be interwoven with all our studies and active employments—and that they should constitute the basis of all those instructions which are intended for the melioration and improvement of mankind? To maintain such a position would be to degrade philosophy in the eyes of every intelligent inquirer, and to render it unworthy of the patronage of every one who has a regard to the happiness of his species. That philosophy which truly deserves the name will at once admit, that concerns of the highest moment ought not to be set aside for matters of inferior consideration; but that every thing should be attended to in its proper order, and according to its relative importance. If such considerations have any weight, they prove, beyond dispute, that there is a glaring deficiency in our methods of education, where a foundation is not laid in the truths of Christianity, and where its authority is overlooked, and its claims disregarded.

Let us consider for a moment what would be the natural effects of *a complete separation* between science and religion—between the general diffusion of knowledge and the great objects of the Christian faith. Science might still continue to prosecute discoveries, to enlarge its boundaries, and to apply its principles to the cultivation of new arts, and to the improvement of those which have hitherto been practised. Its studies might give a certain degree of polish to the mind, might prevent certain characters from running the rounds of fashionable dissipation, and in every gradation in society might counteract, to a certain degree, the tendency to indulgence in those mean and ignoble vices to which the lower ranks in every age have been addicted. But although the standard of morals would be somewhat raised, and the exterior of life polished and improved, the latent principles of moral evil might still remain rankling in the breast. Pride, ambition, avarice, and revenge, receiving no counteraction from religious principle, might be secretly harboured and nourished in the heart, and ready to burst forth on every excitement in all the diabolical energies in which they have so frequently appeared amid the contests of communities and nations. The recognition of a Supreme intelligence, to whom we are accountable, would soon be considered as unnecessary in scientific investigations, and his natural perfections overlooked; and, consequently, all the delightful affections of love, gratitude, admiration, and reverence, which are inspired by the view of his moral attributes and the transcendent excellence of his nature, would be undermined and annihilated. There would be no reliance on the superintending care of an unerring Providence, ordaining and directing every event to the most beneficial purposes, and no consolation derived amid the ills of life, from a view of the rectitude and benevolence of the Divine government. The present world would be considered as the only scene of action and enjoyment; the hope of immortality, which supports and gladdens the pious mind, would be exterminated, and every thing beyond the shadow of death involved in gloom and uncertainty. The only true principles of moral action, which revealed religion inculcates, being overlooked or discarded, every one would consider himself as at liberty to act according as his humour and passions might dictate; and, in such a case, a scene of selfishness, rapacity, and horror would quickly ensue, which would sap the foundations of social order, and banish happiness from the abodes of men.

Such would be the necessary effects of a complete renunciation of revealed religion, and such a state of things our literary and scientific mode of education has a *natural tendency* to produce, *in so far as the truths of Christianity are set aside, or overlooked,* in our plans of instruction. Where should our youths receive impressions of the Deity, and of the truths of religion, unless in those seminaries where they are taught the elements of general knowledge? Shall they be left to infer that religion is a matter of trivial importance, from the circumstance that it is completely overlooked throughout the whole range of their instructions? It may be said that they have opportunities of receiving Christian instruction elsewhere, particularly from the ministers of religion; but will their minds be better prepared for relishing such instructions because the religion of the Bible has been carefully kept out of view in the other departments of tuition? Will they not rather come to such instructions with their minds biassed against the truths of revelation; especially when we consider that in almost every instance where religion is discarded in the process of secular instruction, pagan maxims are introduced, and insinuations occasionally thrown out hostile to the interests of genuine Christianity? Notwithstanding all that I have stated in the preceding pages respecting the beneficial effects of a universal diffusion of knowledge, I am fully persuaded that, unless it be accompanied with a diffusion of the spirit of the Christian religion and a corresponding practice, it will completely fail in promoting the best interests of mankind. If scriptural views of the character of the Deity—if the promotion of love to God and to man—if the cultivation of heavenly tempers and dispositions, and the practice of Christian morality, be entirely overlooked in seminaries devoted to the instruction of the great body of the community—such institutions, instead of being a blessing, would ultimately become *a curse* to the human species; and we should soon behold a vast assemblage of *intelligent demons* furnished with powers and instruments of mischief superior to any that have hitherto been wielded, and which might ere long produce anarchy, injustice, and horror throughout every department of the moral world.

That these are not mere imaginary forebodings might be illustrated from the scenes which were lately exhibited in a neighbouring nation. The first revolution in France, in 1789, was a revolution, not merely in politics and government, but in religion, in manners, in moral principle, and in the common feelings of human nature. The way for such a revolution was prepared by the writings of Voltaire, Mirabeau, Diderot, Helvetius, D'Alembert, Condorcet, Rousseau, and others of the same stamp—in which, along with some useful discussions on the subject of civil and religious liberty, they endeavoured to disseminate principles subversive both of natural and revealed religion. Revelation was not only impugned, but entirely set aside; the Deity was banished from the universe, and an imaginary phantom, under the name of the Goddess of Reason, substituted in his place. Every thing was reduced to a system of pure materialism; the celestial spark of intelligence within us was assimilated to a piece of rude matter, and the fair prospects of immortality which Christianity presents transformed into the gloom of an eternal night. Every previous standard of morals was discarded; every one was left to act as selfishness, avarice, and revenge might dictate; religion of every description fled from the torch of the prevailing philosophy; and while "justice and morality" were proclaimed as "the order of the day," every moral principle and every humane feeling was trampled under foot. It is stated, on good authority, that a little before the revolution, a numerous assembly of French *literati* being asked, in turn, at one of their meetings, by their president, "Whether there was any such thing as moral obligation," answered, in every instance, that *there was not*. Soon after that revolution, the great body of French infidels, who then ruled the nation, not only denied all the obligations which bind us to truth, justice, and kindness, but pitied and despised, as a contemptible wretch, the man who believed in their existence. Atheism was *publicly* preached, and its monstrous doctrines disseminated among the mass of the people, an occurrence altogether novel in the history of man. A professor was even named by Chaumette, to instruct the children of the state in the mysteries of Atheism. De la Metherie, the author of a philosophical journal, when discussing the doctrine of crystallization, made the wild and hideous assertion, "that the highest and most perfect form of crystallization *is that which is vulgarly called God*." In the National Convention, Gobet, Archbishop of Paris, the Rector Vangirard, and several other priests, abjured the Christian religion; and for this abjuration *they received applauses and the fraternal kiss*. A priest from Melun stated, that there is no true religion but that of nature, and that all the mummery with which they had hitherto been amused is only old wives' fables; *and he was heard with loud applause*. The Convention decreed, that "all the churches and temples of religious worship known to be in Paris should be instantly shut up, and that every person requiring the opening of a church or temple should be put under arrest, as a suspected person, and an enemy to the state." The carved work of all religious belief and moral practice was boldly cut down by Carnot, Robespierre, and their atheistical associates, and the following inscription was ordered to be displayed in all the public burying-grounds—"*Death is only an eternal sleep*;" so that the dying need no longer be afraid to step out of existence. Nature was investigated by these pretended philosophers only with a view to darken the mind, to prevent mankind from considering any thing as real but what the hand could grasp or the corporeal eye perceive, and to subvert the established order of society.

The consequence of the operation of such principles were such as might have been expected. They are written in characters of blood, and in crimes almost unparalleled in the history of nations. A scene of inhumanity, cruelty, cold-blooded malignity, daring impiety, and insatiable rapacity was presented to the world, which excited in the mind of every virtuous spectator amazement and horror. Savage atrocities were perpetrated which would have been shocking in the most barbarous and unenlightened age; and, perhaps, at no era has there been more wretchedness occasioned by licentious principles and moral degeneracy. The ties of friendship were cut asunder, the claims of consanguinity disregarded, and a cold-blooded selfishness pervaded the great mass of society. "The kingdom appeared to be changed into one great prison; the inhabitants converted into felons, and the common doom of man commuted for the violence of the sword, and the bayonet, and the stroke of the guillotine." Such was the rapidity with which the work of destruction was carried on, that within the short space of ten years, not less than three millions of human beings (one-half more than the whole population of Scotland) are supposed to have perished in that country alone, chiefly through the influence of immoral principles, and the seductions of a false philosophy. The following is a brief sketch of some of the scenes to which we allude, drawn by one who was an eyewitness of the whole, and an actor in several parts of that horrid drama. "There were," says this writer, "multiplied cases of suicide; prisons crowded with innocent persons; permanent guillotines; perjuries of all classes; parental authority set at naught; debauchery encouraged by an allowance to those called unmarried mothers; nearly six thousand divorces in the city of Paris within a little more than two years; in a word, whatever is most obscene in vice and most dreadful in ferocity."*

Notwithstanding the incessant shouts of "Liberty and equality," and the boasted illuminations of philosophy, the most barbarous persecutions were carried on against those whose religious opinions differed from the system adopted by the state. While infidelity was enthroned in power, it wielded the sword of power with infernal ferocity against the priests of the Romish church, who were butchered wherever found—hunted as wild beasts—frequently roasted alive, or drowned in hundreds together, without either accusation or trial. At Nantz, no less than 360 priests were shot, and 460 drowned. In one night, 58 were shut up in a barge, and drowned in the Loire. Two hundred and ninety-two priests were massacred during the bloody scenes of the 10th August and 2d September, 1792; and 1135 were guillotined under the government of the National Convention, from the month of September, 1792, till the end of 1795, besides vast numbers, hunted by the infidel republicans, like owls and partridges, who perished in different ways, throughout the provinces of France.

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* Gregoire.

Such were some of the dismal effects which flowed from the attempt to banish religion from science, from government, and from the intercourses and employments of society. Were such principles universally to prevail, the world would soon become one vast theatre of mischief and of misery—an immense den of thieves and robbers,—a sink of moral pollution—a scene of impiety, injustice, rapine, and devastation; a Golgotha, strewed with carcasses and "dead men's bones." All confidence and friendship between intelligent beings would be destroyed; the dearest and most venerable relations would be violated by incestuous pollutions; appetite would change every man into a swine, and passion into a tiger; jealousy, distrust, revenge, murder, war, and rapine would overspread the earth, and a picture of hell would be presented wherever the eye roamed over the haunts of men.

During the period when the atrocities to which we are adverting were perpetrating, the ruffians who bore rule in France were continually imputing to the illumination of philosophy the ardour which animated them in the cause of liberty; and it is a truth, that science was enlarging its boundaries even amid the horrors with which it was surrounded. Chymistry was advancing in its rapid career of discovery, and the celebrated Lavoisier, one of its most successful cultivators, was interrupted in the midst of some interesting experiments, and dragged to the guillotine, where he suffered in company with 28 farmers-general, merely because he was rich. Physical astronomy and the higher branches of the mathematics were advancing under the investigations of La Place; geodetical operations were carrying forward, on an extensive scale; and the physical sciences, in general, under the hands of numerous cultivators, were going on towards perfection. But while this circumstance shows that science may advance in the midst of irreligion—it proves, at the same time, that, *without being combined* *with religion*, it cannot, of itself, meliorate the morals of mankind, or counteract the licentiousness of society. Though it may be considered as a ray of celestial light proceeding from the original source of intelligence, yet it will fail in producing its most beneficial effects, unless it be combined with "the light of the knowledge of the glory of God," as it shines in the word of Divine Revelation. Had such a connexion been formed between science and religion, certain it is that the bonds which unite the social system would never have been burst asunder, nor the foundations of morality overturned by such a violent explosion as happened at the French revolution. And although I am aware that a variety of political causes combined to produce that great convulsion, and the effects which flowed from it, yet it cannot be denied, that the principles of atheism, and a false philosophy which had thrown off its allegiance to Christianity, were the *chief causes* which produced the licentiousness and impiety which characterized the rulers and citizens of France, under "the reign of terror."

It is therefore to be hoped, that those who now patronise the intellectual improvement of mankind, and who wish to promote the best interests of society, will take warning from the occurrences which so lately happened in the French nation, during the reign of infidel philosophy and impiety, and not suffer religion to be dissevered from those pursuits which should lead the mind to the contemplation of a Supreme intelligence, and of the glories of an immortal existence. The moral Governor of the world has set before us the horrid scenes to which we have alluded, as a beacon to guard us from similar dangers, that society might not again be exposed to a shipwreck so dreadful and appalling. We have, surely, no reason to repeat the experiment in order to ascertain the result. It is written in characters conspicuous to every eye, and legible even to the least attentive observer, and may serve as a warning both to the present age and to every future generation. Its effects are felt even at the present moment, in the country where the experiment was tried, in the irreligion and profligacy which, in its populous cities, still abound, especially among the middle and higher ranks of society. Its effects are apparent even in our own country; for the skeptical principles and immoral maxims of the continental philosophy were imported into Britain, at an early period of the French revolution, when the Bible was discarded by multitudes, as an antiquated imposture, and committed to the flames; and it is, doubtless, owing in part to the influence of these principles that, in organizing institutions for the diffusion of knowledge among the lower ranks, attempts have been made to separate science from its references to the Creator, and from all its connexions with revealed religion. It is, therefore, the duty of every man who loves his species, and who has a regard for the welfare and prosperity of his country, to use his influence in endeavouring to establish the literary and scientific instruction of the community on the broad basis of the doctrines of revelation, and of those moral laws which have been promulgated by the authority of the Governor of the universe, which are calculated to secure the moral order and to promote the happiness of intelligent agents, throughout every province of the Divine empire.

"When we look at plans of education," says an intelligent writer, "matured, or in progress, which are likely to concentrate the *national intellect*, and form the *national taste*, and engross the daily leisure of the peasant or artisan, on principles of virtual exclusion to every thing specifically Christian, when we see this grievous and deadly deficiency attaching to schemes of benevolence, which are otherwise pure and splendid, receiving the sanction of public recognition, countenanced or winked at by the mightiest of scholars and most illustrious statesmen, and thus put in condition for traversing the land, from the one end to the other, we do feel alarmed, in no ordinary degree, at the effects that are likely to follow it; and could we influence the consultations in which the whole originates, would entreat its projectors to pause and deliberate, lest they stir the elements of a latent impiety, instead of dispensing a national blessing. We dread not the light of science, nor any light of any kind which emanates from God to man. On the contrary, we hail it as a precious acquisition, provided it be mingled and seasoned with that which is revealed as "the true light which lighteth every man that cometh into the world;" but, in a state of separation from this better light, and unattempered by its restoring influence, we are constrained to dread it, by all the concern we ever felt for the eternal well-being of our human kindred."*

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* Rev. D. Young—Introductory Essay to Sir M. Hales's Contemplations.

To prevent any misconceptions that may arise respecting our views of the connexion of science and religion, it may be proper to remark, in the first place, that we would consider it preposterous in the highest degree to attempt the introduction of sectarian opinions in religion into the discussions connected with science and philosophy. It would be altogether irrelevant to the objects of scientific associations to introduce the subjects of dispute between Calvinists and Arminians, Presbyterians, Episcopalians, and Independents; and we are of opinion, that the sooner such controversies are banished, even from *theology*, and from the Christian world at large, so much the better; for they have withdrawn the minds of thousands from the *essentials* to the mere *circumstantials* of religion; and, in too many instances, have exposed the Christian world to the sneers of infidels, and the scoffs of the profane.—Nor, in the next place, would we consider it as either judicious or expedient to attempt to foist in even the essential doctrines of Christianity, on every occasion, when the subject of discussion did not *naturally* and *directly* lead to their introduction, or to some allusions to them. Such attempts generally frustrate the end intended, and are equally displeasing to the man of taste, and to the enlightened Christian.—What we understand by connecting science with religion will appear in the following observations:—

I. As science has it for one of its highest objects to investigate the works of the Creator,—*an opportunity should be taken*, when imparting scientific instructions, *of adverting to the attributes of the Deity as displayed in his operations.* The character of the Divine Being, and the perfections he displays, are, in every point of view, the most interesting of all human investigations. The system of nature, in all its parts and processes, exhibits them to our view, and forces them, as it were, upon our attention, if we do not wilfully shut our eyes on the light which emanates from an invisible Divinity through his visible operations. The contemplation of this system, even in its most prominent and obvious appearances, has a natural tendency to inspire the most profound emotions of awe and reverence, of gratitude and admiration, at the astonishing displays it exhibits of Omnipotent energy, unsearchable wisdom, and boundless beneficence. Such studies, when properly directed, are calculated to make a powerful and interesting impression on the minds of the young; and it is doing them an incalculable injury, when their views are never elevated above proximate causes and physical laws, to the agency of Him who sits on the throne of the universe.—"If one train of thinking," says Paley, "be more desirable than another, it is that which regards the phenomena of nature, with a constant reference to a supreme intelligent Author. To have made this the ruling, the habitual sentiment of our minds is to have laid the foundation of every thing which is religious. The world from henceforth becomes a temple, and life itself one continued act of adoration. The change is no less than this, that whereas formerly God was seldom in our thoughts, we can scarcely look upon any thing without perceiving its relation to him." And is such a train of thinking to be considered as unphilosophical? Is it not, on the contrary, the *perfection* of philosophy to ascend to a cause that will account for every phenomenon—to trace its incessant agency, and to acknowledge the perfections it displays? Bishop Watson has well observed, "We feel the interference of the Deity everywhere, but we cannot apprehend the *nature* of his agency anywhere. A blade of grass cannot spring up, a drop of rain cannot fall, a ray of light cannot be emitted from the sun, nor a particle of salt be united with a never-failing sympathy to its fellow, without him; every secondary cause we discover is but a new proof of the necessity we are under of ultimately recurring to him as the one primary cause of every thing."

Illustrations of the position for which we are now contending will be found in such works as the following:—Ray's "Wisdom of God in the Creation,"—Boyle's "Philosophical and Theological Works,"—Derham's "Astro and Physico-Theology,"*—Nieuwentyt's "Religious Philosopher,"—Le Pluche's "Nature Displayed,"—Baxter's "Matho," or the principles of natural religion deduced from the phenomena of the material world,—Lesser's "*Insecto-Theology*," or a demonstration of the Being and Attributes of God, from the structure and economy of insects, with notes by Lyonet,—Bonnet's "Contemplation of Nature,"—Euler's "Letters to a German Princess," *translated by Hunter*, —Pierre's "Studies of Nature,"—Paley's "Natural Theology,"—Adam's "Lectures on Natural Philosophy,"—Parkes's "Chymical Catechism," and several others. The chief object of *Ray* is to illustrate the wisdom of the Deity in the figure and construction of the earth, in the structure and symmetry of the human frame, and in the economy of the animal and vegetable tribes. The object of Derham, in his Astro-Theology, is to display the wisdom and omnipotence of Deity, as they appear in the structure, arrangement, and motions of the heavenly bodies; and his *Physico-Theology*, a work of much greater extent, demonstrates the being and attributes of God from the constitution of the earth and atmosphere,—the senses,—the structure, motions, respiration, food, and habitations of animals,—the body of man,—the economy of insects, reptiles and fishes,—and the structure of vegetables. Though this excellent work is now considered as somewhat antiquated, yet we have no modern work that can fully supply its place. Paley's Natural Theology, however excellent in its kind, does not embrace the same extensive range of objects. *Nieuwentyt* enters into a minute anatomical investigation of the structure of the human body, which occupies the greater part of his first volume; and in the two remaining volumes illustrates the Divine perfections from a survey of the atmosphere, meteors, water, earth, fire, birds, beasts, fishes, plants, the physical and chymical laws of nature, the inconceivable smallness of the particles of matter, and the structure of the starry heavens. The voluminous work of *Le Pluche* comprehends interesting descriptions of quadrupeds, birds, fishes, insects, plants, flowers, gardens, olive-yards, corn-fields, woods, pasture-grounds, rivers, mountains, seas, fossils, minerals, the atmosphere, light, colours, vision, the heavenly bodies, globes, telescopes, microscopes, the history of navigation, systematic physics, &c.—interspersed with a variety of beautiful reflections, on the wisdom and beneficence of the Deity in the arrangements of nature. *Euler's* Letters comprehend popular descriptions of the most interesting subjects connected with natural philosophy and ethics, interspersed with moral reflections, and frequent references to the truths of revelation. *Condorcet*, in his French translation of this work, carefully omitted almost all the pious and moral reflections of this profound and amiable philosopher, as inconsistent with the infidel and atheistical philosophy which then prevailed. "The retrenchments," says he, "affect reflections which relate less to the sciences and philosophy than to theology, and frequently even to the peculiar doctrines of that ecclesiastical communion in which Euler lived. *It is unnecessary to assign a reason for omissions of this description.*" These omissions were supplied, and the passages alluded to restored, by Dr. Hunter, in his English translation, but they have been again suppressed in the late edition, published in Edinburgh, in two volumes, 12mo.*

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* An edition of Derham's *Physico-Theology*, in two vols. 8vo. (which is not very generally known), was published in London in 1798, which contains *additional notes* illustrative of modern discoveries, a translation of the Greek and Latin quotations of the original work, a life of the author, and sixteen copperplate engravings, illustrative of many curious subjects in the animal and vegetable kingdoms.

It is much to be regretted that we have no modern Rays, Derhams, Boyles, or Nieuwentyts, to make the light of our recent discoveries in science bear upon the illustration of the perfections of the Deity, and the arrangements of his providence. Since the period when those Christian philosophers left our world, many of the sciences which they were instrumental in promoting have advanced to a high degree of perfection, and have thrown additional light on the wisdom and intelligence of the Divine mind, and the economy of the universe. Natural history has widely enlarged its boundaries; our views of the range of the planetary system have been extended; the distant regions of the starry firmament have been more minutely explored, and new objects of magnificence brought within the reach of our observation. The nature of light has been more accurately investigated, the composition of the atmosphere discovered, the properties of the different gases ascertained, the powers of electricity and galvanism detected, and chymistry—a science completely new-modelled—has opened up the secret springs of nature's operations, and thrown a new light on the economy of Divine wisdom in the various processes which are going on in the material system. Is it not unaccountable, then, that no modern system of *Physico-Theology*, embracing the whole range of modern discoveries, should have proceeded from the pens of some one or other of our most distinguished philosophers? Does this circumstance seem to indicate, that, since the early part of the last century, the piety of philosophers has been declining, and the infidel principles of the Continental school gaining the ascendency? Infidelity and fatalism very generally go hand in hand. When the truths of Revelation are once discarded, a species of universal skepticism, differing little or nothing from atheism, takes possession of the mind; and hence we find, that in the writings of such men as Buffon, Diderot, and La Place there is not the slightest reference to final causes, or to the agency of an All-pervading Mind that governs the universe.

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* As a specimen of the omissions to which we allude, the following passage may suffice:—"But the eye, which the Creator has formed, is subject to no one of all the imperfections under which the imaginary construction of the freethinker labours. In this we discover the true reason why Infinite Wisdom has employed several transparent substances in the formation of the eye. It is thereby secured against all the defects which characterize every work of man. What a noble subject of contemplation! How pertinent that question of the Psalmist! *He who formed the eye, shall he not see? and He who planted the ear, shall he not hear?* The eye alone being a masterpiece that far transcends the human understanding, what an exalted idea must we form of Him who has bestowed this wonderful gift, and that in the highest perfection, not on man only, but on the brute creation, nay, on the vilest of insects!" The French philosopher and statesman seems to feel ashamed of the least alliance between philosophy and religion, when he is induced to discard such reflections. He seems apprehensive, as Dr. Hunter remarks, that a single drop of water from Scripture would contaminate the whole mass of philosophy. We would hope our British philosophers are not yet so deeply tinctured with the spirit of infidelity.

That the connexion between science and theology we have been recommending is not a vague or enthusiastic idea appears from the sentiments which have been expressed on this subject by the most eminent philosophers. Throughout the whole of the works of the immortal Newton, we perceive a constant attention to final causes, or to the great purposes of the Deity. It was the firm opinion of this philosopher, "that, as we are everywhere encountered in our researches by powers and effects which are unaccountable upon any principles of mere mechanism, or the combinations of matter and motion, we must for ever resort to a Supreme power, whose influence extends over all nature, and who accomplishes the wisest and most benevolent ends by the best possible means." Maclaurin, the friend of Newton, and the commentator on his *Principia*, expresses the following sentiments on this subject, in his "Account of Sir I. Newton's Discoveries." "There is nothing we meet with more frequently and constantly in nature than the traces of an all-governing Deity. And the philosopher who overlooks these, contenting himself with the appearances of the material universe only, and the mechanical laws of motion, neglects what is most excellent; and prefers what is imperfect to what is supremely perfect, finitude to infinity, what is narrow and weak to what is unlimited and almighty, and what is perishing to what endures for ever. Such who attend not to so manifest indications of supreme wisdom and goodness, perpetually appearing before them wherever they turn their views or inquiries, too much resemble those ancient philosophers who made *Night*, *Matter*, and *Chaos* the original of all things." Similar sentiments were expressed by the late Professor Robison, one of the most profound mathematicians and philosophers of his age. "So far from banishing the consideration of final causes from our discussions, it would look more like philosophy, more like the love of true wisdom, and it would taste less of an idle curiosity, were we to multiply our researches in those departments of nature where final causes are the chief objects of our attention—the structure and economy of organized bodies in the animal and vegetable kingdoms."—"It is not easy to account for it, and perhaps the explanation would not be very agreeable, why many naturalists so fastidiously avoid such views of nature as tend to lead the mind to the thoughts of its Author. We see them even anxious to weaken every argument for the appearance of design in the construction and operations of nature. One would think, that, on the contrary, such appearances would be most welcome, and that nothing would be more dreary and comfortless than the belief that chance or fate rules all the events of nature."—*Elements of Mechanical Philosophy*, vol. i. p. 681, 682. We know not whether such sentiments were inculcated from the chair of Natural Philosophy, which Dr. Robison so long occupied, by the distinguished philosopher who has lately deceased.

II. Besides the deductions of natural religion to which we have now adverted—in our scientific instructions there ought to be a reference, on every proper occasion, to the leading truths of revelation. There are many scientific inquirers who would have no objections occasionally to advert to final causes and the wisdom of the Deity, who consider it altogether irrelevant, in the discussions of science, to make the slightest reference to the facts and doctrines detailed in the Sacred Oracles. The expediency or the impropriety of such a practice must depend on the views we take of the nature of the communications which the Scriptures contain. If the Bible is acknowledged *as a revelation from God*, its truths must harmonize with the system of nature,—they must throw a mutual light on each other,—and the attributes of the Divinity they respectively unfold must be in perfect accordance; and therefore it can never be irrelevant, when engaged in the study of the one, to refer for illustrations to the other. On the contrary, to omit doing so from a fastidious compliance with what has too long been the established practice would be a piece of glaring inconsistency, either in the theologian on the one hand, or the philosopher on the other. We have too much reason to suspect, that the squeamishness of certain scientific characters, in omitting all references to the Christian system, arises either from a secret disbelief of its authority, or from a disrelish of the truths and moral principles it inculcates.

Taking for granted, then, what has never yet been disproved that Christianity is a revelation from heaven, and recollecting that we live in a country where this religion is professed, follows, as a matter of *consistency* as well as of *duty*, that all our systems of instruction, whether literary or scientific, whether in colleges, academies, mechanics' institutions, or initiatory schools, ought to be founded on the basis of the Christian revelation—that, in the instructions delivered in such seminaries, its leading doctrines should be recognised, and that no dispositions or conduct be encouraged which are inconsistent with its moral principles.

More particularly, in describing the processes or phenomena of nature, an opportunity should frequently be taken of quoting the sublime and energetic sentiments of the inspired writers, and of referring to the facts they record, when they are appropriate and illustrative of the subject in hand. This would tend to connect the operations of nature with the agency of the God of nature; and would show to the young, that their instructers felt a veneration for that Book which has God for its Author, and our present and future happiness as the great object of its revelations. Why should the Bible be almost the only book from which certain modern philosophers never condescend to borrow a quotation? They feel no hesitation—nay, they sometimes appear to pride themselves in being able to quote from Plato, Aristotle, and Zeno, or from Ovid, Virgil, and Lucretius. They would feel ashamed to be considered as unacquainted with the works of Bacon, Galileo, Newton, Halley, Huygens, Boscovich, Black, Robison, Buffon, or La Place, and unable to quote an illustrative sentiment from their writings; but they seem to feel as if it would lessen the dignity of science to borrow an illustration of a scientific position from Moses or Isaiah, and to consider it as in nowise disrespectful to appear ignorant of the contents of the Sacred Volume. Such were not the sentiments and feelings of the philosophers to whose works I lately referred, which abound with many beautiful and appropriate sentiments from the inspired writings. Such were not the feelings of the celebrated *Euler*, whose accomplishments in science were admired by all the philosophers of Europe; nor were such the feelings of the late Dr. Robison, who was scarcely his inferior. When describing the numerous *nebulæ* in the distant regions of the heavens, he closes his remarks with the following reflection: "The human mind is almost overpowered with such a thought. When the soul is filled with such conceptions of the extent of created nature, we can scarcely avoid exclaiming 'Lord, what then is man, that thou art mindful of him?' Under such impressions, David shrank into nothing, and feared that he should be forgotten among so many great objects of the Divine attention. His comfort and ground of relief from this dejecting thought are remarkable. 'But,' says he, 'thou hast made man but a little lower than the angels, and hast crowned him with glory and honour.' David corrected himself, by calling to mind how high he stood in the scale of God's works. He recognised his own divine original, and his alliance to the Author of all. Now, cheered and delighted, he cries out, 'Lord, how glorious is thy name!' "—*Elements of Mechanical Philosophy*, vol. i. p. 565.

Again, every proper opportunity should be taken of illustrating the *harmony* which subsists between the system of revelation and the system of nature—between the declarations of the inspired writers and the facts which are found to exist in the material universe. This subject presents an extensive field of investigation, which has never yet been thoroughly explored, and which admits of the most extensive and diversified illustrations. The facts of *geology*—some of which were formerly set in array against the records of revelation—are now seen to be corroborative of the facts stated in the Mosaic history;* and in proportion as the system of nature is minutely explored, and the physical sciences in general approximate to perfection, the more striking appears the coincidence between the revelations of the Bible and the revelations of Nature. And one principal reason why this coincidence at present does not appear complete is, that the Scriptures have never yet been thoroughly studied in all their references, nor the system of the material world thoroughly explored. The facts of modern science, of which many of our commentators were ignorant, have seldom been brought to bear upon the elucidation of the inspired writings, and the sentiments of the sacred writers have seldom been illustrated by an appeal to the discoveries of science. The views which the system of nature exhibits of the plan and principles of the Divine government, the reasons of the operation of those destructive agents which frequently exert their energy within the bounds of our sublunary system, and the connexion which subsists between *physical* and *moral* evil, might also form occasional subjects of investigation; as they are all deeply interesting to man considered as a moral agent, and as the subject of the moral administration of the Governor of the Universe.

In the next place, we hold it as a matter of particular importance, that the instructions of science be conducted in such a manner as to make a *moral impression* upon the heart. An objection has frequently been raised by religious people against the study of science, from its tendency to produce a spirit of intellectual pride; and it can scarcely be denied that there is some ground for the objection, when the pursuits of general knowledge are entirely separated from religion. But the objects of science, *when properly exhibited, and accompanied with appropriate reflections*, have a very different tendency. When we consider the numberless multitudes of beings which exist in the universe, and the immense variety of processes incessantly going forward in every department of nature; when we consider the infinite wisdom and intelligence, far surpassing human comprehension, which they display; when we consider the immense magnitude and extent of the universal system of created beings, and the probability that man stands near the lower part of the scale of rational existence, and is only like an atom in the immensity of creation,—we perceive the most powerful motives for *humility* and self-abasement. When we consider the benevolent arrangements in the elements around us, and in the structure and functions of animated beings, and the provision made for their subsistence, it has a natural tendency to inspire the heart with *gratitude* and affection towards Him from whom all our comforts flow. And when we reflect on the grandeur of the Deity as displayed in the magnificence of his empire, and in his incessant agency throughout all its provinces, should it not inspire us with reverence and adoration, and with a lively hope that a period will arrive when we shall behold the wonders and glories of his creation more clearly unfolded? Such sentiments and emotions the works of God, when rightly contemplated, are fitted to produce; and to overlook them in our instructions to the young is to deprive them of some of the purest enjoyments, and some of the greatest advantages, which flow from scientific knowledge. When their minds are deeply impressed with such emotions, they are in some measure prepared for listening with reverence to the declarations of the inspired volume, and for perceiving the force and sublimity of the descriptions it gives of the character of God.

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* For illustrations of this position, see Dr. Ure's Geology, Parkinson's Organic Remains, &c.

It would perhaps excite a smile of contempt in some who would spurn at the idea of being ranked in the class of infidels were I to insinuate, that our scientific meetings and lectures should be opened with prayer, and adoration of the Divine Being. It might indeed admit of a doubt whether it would be expedient to attempt such a practice *in the present state of society*. But I have no hesitation in affirming, that to acknowledge God in all our pursuits, and to pay

Him a tribute of adoration, are dictates of natural as well as of revealed religion, and that a Deist, were he to act in consistency with his avowed principles, would engage in daily prayer to the Great Author of his existence. It is expressly enjoined in the Scriptures, "In all thy ways acknowledge God, and he shall direct thy steps;" and it is declared to be one of the characteristics of the wicked man, "that God is not in all his thoughts," and that "through the pride of his countenance he will not call upon God." If we firmly believe there is a God, we must also believe that he is present in all places, and privy to all our thoughts, that all our circumstances and wants are open to his Omniscient eye, and that "he is able to do for us above all that we can ask or think." Although we are ignorant of the precise physical connexion between prayer and the bestowment of a favour by God, yet we ought to engage in this duty, because it is accordant with the idea of a Supreme Being, on whom we are every moment dependent, and has therefore been acknowledged by the untaught barbarian, as well as by the enlightened Christian; because it is positively enjoined; because there is a connexion established by the Creator between *asking* and *receiving;* because it tends to fix our thoughts on the Omnipresence of the Divine Mind, to impress our hearts with a sense of the blessings of which we stand in need, and to excite earnest desires after them; and because it is one way in which we may hold a direct intercourse with our Creator. I would not envy the Christian feelings of that man who can habitually engage in literary compositions or scientific discussions, without acknowledging his Maker, and imploring his direction and assistance. Religion degenerates into something approaching to a mere inanity when its spirit and principles are not carried into every department of human life and society, nor its requisitions attended to in every *secular* business in which we engage. Till the principles of Christianity be made to bear in all their force on every department of human actions, and especially on the business of education, we can scarcely expect that its benign tendency will be generally appreciated, or that society will reap all the benefits which it is calculated to impart.

There are, however, certain descriptions of literary characters, who, although they consider it expedient to pay an occasional compliment to Christianity, would consider such remarks as bordering on superstition or fanaticism. When we talk to them about the Christian revelation, in general terms, they do not choose to say any thing directly against its excellence or divine authority; but if we descend into particulars, and expatiate on any of its fundamental doctrines, or attempt to reduce to practice its holy requisitions, we are frequently met with a contemptuous sneer, or a cry of enthusiasm, and sometimes with a harangue against the follies of Methodism, or of Bible and Missionary Societies. We are thus led to infer, with some degree of reason, that such characters have no impressive belief of the Divine origin of the Christian system; and it would be much more honourable and consistent at once to avow their infidelity, than to put on the mask of dissimulation and hypocrisy. No individual ought to be subjected to any civil penalties on account of the opinions he holds, as for these he is accountable only to his Maker; nor should any opinions be attempted to be extirpated by any other weapons than the strength of reason and the force of arguments. But, at the same time, it is requisite that society should know the leading principles of any one who proposes himself as a public instructer of his fellow-men, in order that they may judge whether it would be proper to place their relatives under the instructions of one who might either overlook Christianity altogether, or occasionally throw out insinuations against it. To act the hypocrite, to profess a decent respect for the Christian religion, while the principles of infidelity are fixed in the mind, accompanied with a secret wish to undermine its foundations, is *mean* and *contemptible*, unworthy of the man who wishes to be designated by the title of philosopher. Yet such hypocrisy is not at all uncommon; it was particularly displayed by the skeptical philosophers on the Continent, prior to the French revolution, and avowed to their most intimate associates.

Buffon, the natural historian, who appears to have been an atheist, was also, according to his own confession, a consummate hypocrite. In a conversation with *M. Herault Sechelles*, in 1785, about four years before his death, and when he was in the seventy-eighth year of his age, he declared, "In my writings I have always spoken of the *Creator*; but it is easy to efface that word, and substitute in its place the *powers of nature*, which consist in the two grand laws of attraction and repulsion. When the *Sorbonne*[*] became troublesome to me, I never scruple to give them every satisfaction they require. It is but a *sound*, and men are foolish enough to be contented with it. Upon this account, if I were ill, and found my end approaching, I should not hesitate to receive the sacrament. *Helvetius* was my intimate friend, and has frequently visited me at Montbart. I have repeatedly advised him to use similar discretion; and, had he followed my advice, he would have been much happier." "My first work," continued he, "appeared at the same time with *L'Esprit des Lois*. *Montesquieu* and myself were tormented by the *Sorbonne*. The president was violent. '*What have you to answer for yourself?*' says he to me, in an angry tone. '*Nothing at all*,' was my answer, and he was silenced and perfectly thunderstruck at my indifference." In perfect accordance with such a system of hypocrisy, Buffon kept a father confessor almost constantly with him, to whom he was in the habit of *confessing*, in the same apartment where he had developed the *Principles of Materialism*, which, according to his system, was an abnegation of immortality. He also regularly attended mass on Sundays, unless prevented by indisposition, and communicated in the *Chapel of the Glory*, every Whitsuntide. Though he heartily despised his priestly confessor, he flattered and cajoled him with pompous promises, and condescending attentions. "I have seen this priest," says Sechelles, "in the absence of the domestics, hand over a towel to the count, set the dining-table before him, and perform such-like menial services. Buffon rewards these attentions with, *I thank you, my dear child*." Such was the habitual hypocrisy of this philosopher; and, said he, "it has been observed by me in all my writings: I have published the one after the other in such a manner, that men of vulgar capacities should not be able to trace the chain of my thoughts." His intolerable *vanity* and pomposity, his breach of promises, the grossness of his conversation, and his numerous amours and intrigues were in perfect correspondence with such principles, and the natural result of them. "His pleasantries," says Sechelles, "were so void of delicacy, that the females were obliged to quit the room."* What a scene of moral anarchy would be introduced, were such principles to be universally inculcated and acted upon in society! All confidence between man and man would be shaken, and the foundations of the social system undermined and destroyed. Yet such was the morality which almost universally prevailed among the continental philosophers, in consequence of the skeptical and atheistical principles they had imbibed. Truth, sincerity, modesty, humility, and moral obligation formed no part of the code of their morality; and such, in all probability, would soon be the result in our own country, were the pursuits of science and philosophy to be completely dissevered from religion.

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[*] The faculty of Theology at Paris.

In the last place, there are several topics connected with religion which might occasionally be made the subjects of discussion in scientific associations: such, for example, are the evidences and importance of the Christian Revelation—the physical and moral facts to which it occasionally adverts—the attributes of the Divinity—the general principles of moral action—the laws which the Creator has promulgated for preserving the order of the intelligent system, and the foundation on which they rest—the evidences for the immortality of the soul, and the eternal destiny of man. These and similar topics might, on certain occasions, become subjects of investigation, as they can be illustrated without entering on the arena of theological controversy, or descending within the limits of sectarian opinions. I do not mean to say that they should be discussed according to the method of forensic disputations, by opposite parties taking different sides of a question—a mode of communicating knowledge the tendency of which is very questionable—but that certain positions in reference to them should be proved and illustrated, in a direct manner, in the form of essays, lectures, or oral instructions. The topics now specified, and those which are intimately related to them, are subjects of the deepest interest and importance to every individual of the human race; and, therefore, no valid reason can be assigned why such subjects should not be occasionally elucidated in literary and scientific seminaries, if it be one object of such institutions to promote the happiness and—what is essentially requisite to it—the moral improvement of mankind.

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* See an account of some particulars in the private life of Buffon, by M. Sechelles, one of his admirers, in the Monthly Magazine for July, 1797, supplementary No. vol. 3, p. 493–501.

For example, is it not in the highest degree important to every human being that he should be convinced of his immortal destiny, and have his mind impressed with the realities of a future world—that he should ascertain whether, at death, he is to be reduced for ever into the same situation as the clods of the valley, or transported to a more expansive sphere of existence? Take away from man the prospect of immortality, and you throw a veil of darkness and mystery over all the scenes of creation; you reduce the moral world to a scene of confusion, and involve the ways of Providence in a dark inextricable maze; you inwrap the character of the Deity in awful obscurity, and terminate every prospect of becoming more fully acquainted with the magnificence of the universe; you reduce man to an *enigma*—to the most inexplicable phenomenon in creation, and annihilate the strongest motives to the practice of virtue. But this is not all; you remove the most powerful motives to the pursuit of scientific knowledge; for, in this case, you confine its beneficial results merely to the promotion of the comforts and conveniences of the present transitory life; and the discoveries of the order and extent of the universe it unfolds, and the speculations to which they lead, tend only to bewilder and perplex the mind, when it is cut off from all hopes of prosecuting its inquiries beyond the grave, and of beholding the mysterious scenes of creation more fully displayed. On this ground, a man who is exhorted to cultivate an acquaintance with science might, with some reason, exclaim, "Of what avail is it to spend anxious days and sleepless nights in acquiring scientific knowledge, when it may be all lost before to-morrow's dawn, or, at the farthest, after the lapse of a few short years, when my intellectual faculties shall be annihilated? I can acquire but a few scattered fragments of it at most, although I were to prosecute my researches as far as the most distinguished geniuses have ever advanced; and I must quit the field of investigation before the ten-thousandth part of it is half explored. Had I a prospect of enlarging my faculties and resuming my researches in a future state of being, I might engage in them with some degree of interest and vigour; but to one who is uncertain whether his connexion with the intelligent universe shall be continued for another day, it appears quite preposterous, and tends to deprive me of many sensitive gratifications which I find essential to my present enjoyment." What is affirmed of happiness, in general, may be applied to knowledge, one of its ingredients, that the expectation of its *permanency* is indispensably requisite to its perfection. It is the prospect of science being prosecuted in a future world and carried to perfection, that confers a dignity on its objects, and forms the most powerful motive to engage in its pursuits; and, in this point of view, it may be considered as forming a part of that training which is requisite to prepare us for the activities, the contemplations, and enjoyments of that higher sphere of existence. But where no such hopes are indulged, intellectual pursuits are deprived of their chief excellence and importance, and the best affections of the heart of their sublimest objects and most exalted pleasures; and the more the powers of the mind have been exercised and improved, and the more it feels itself prepared for a series of rational enjoyments, the more chagrined and disappointed must it feel when years roll away, and it approaches the point where it is to sink into eternal oblivion. Without the hopes of admission to future sources of enjoyment, at the hour of dissolution, we may assume an air of composure, because we are unable to resist, or an air of fortitude from the last efforts of pride; but, in point of fact, we can await the extinction of our being only with a mournful and melancholy gloom.

This representation has frequently been realized in the case of men of cultivated minds, who had thrown aside the obligations of religion and the idea of a future world, when they approached the confines of the tomb; of which the following instances may suffice:—*Voltaire*, when approaching his dissolution, looked back upon protracted years with remorse, and forward with dismay. He wished for annihilation through the dread of something worse. He attempted to unburden his troubled mind by confession to a priest; and he placed his hopes of peace with Heaven in an eager conformity to those rituals which he incessantly treated with contempt. In a previous indisposition he insisted upon sending for a priest, contrary to the warmest remonstrances of his friends and attendants. On recovery he was ashamed of his conduct, and ridiculed his own pusillanimity. This pusillanimity, however, returned upon a relapse; and he had again recourse to the miserable remedy. He acknowledged to *Dr. Tronchin*, his physician, the agonies of his mind, and earnestly entreated him to procure for his perusal a treatise written against *the eternity of future punishment.* These facts were communicated to Dr. Cogan by a gentleman highly respected in the philosophical world, who received them directly from *Dr. Tronchin;* and they concur with many others in demonstrating the impossibility of enjoying permanent felicity without the hopes and consolations of religion. M. Sechelles, to whose narrative I lately referred, relates, that in one of his conversations with *Buffon*, the count declared, "I hope to live two or three years longer, to indulge my habit of working in literary avocations. I am not afraid of death, and am consoled by the thought that my name will never die. I feel myself fully recompensed for all my labours by the respect which Europe has paid to my talents, and by the flattering letters I have received from the most exalted personages." Such were the consolations which this philosopher enjoyed in the prospect of the extinction of his being. His *name* would *live* when he himself was for ever blotted out from that creation which it was the object of his writings to describe! But that his mind was not altogether reconciled to the idea of sinking into eternal oblivion may be inferred from another anecdote, related by the same gentleman. "One evening I read to Buffon the verses of *Thomas* on the immortality of the soul. He smiled. '*Par Dieu*,' says he, '*religion would be a valuable gift if all this were true.*'" This remark evidently implied that the system he had adopted was not calculated to present so cheerful a prospect of futurity as the system of Revelation.

Gibbon, the celebrated historian of the "Rise and Fall of the Roman Empire," had his mind early tinctured with the principles of infidelity; and his historical writings are distinguished by several insidious attacks on Christianity, by unfair and unmanly sneers at the religion of his country, and by the loose and disrespectful manner in which he mentions many points of morality regarded as important even on the principles of natural religion. Such appears to have been his eagerness in this cause, that he stooped to the most despicable pun, or to the most awkward perversion of language, for the pleasure of turning the Scripture into ribaldry, or calling Jesus an impostor. Yet he appears to have been actuated by the same spirit of hypocrisy which distinguished Buffon and his philosophical associates; for, notwithstanding his aversion to Christianity, he would have felt no scruple in accepting an office in the *church*, provided it had contributed to his pecuniary interests. On the occasion of his father having been obliged to mortgage part of his estate, he thus expresses himself: "I regret that I had not embraced the lucrative pursuits of the law or of trade, the chances of civil office or India adventure, *or even the fat slumbers of the church*." Such is too frequently the morality displayed by infidels, and there is reason to suspect that the church is not altogether purged of them even in the present day. That Gibbon's principles were not sufficient to support his mind in the prospect of dissolution appears from many expressions in the collection of his letters published by Lord Sheffield; in which are to be traced many instances of the high value which he placed upon existence, and of the regret with which he perceived his years to be rapidly passing away. His letter on the death of Mrs. Posen bears every mark of the despondent state of his mind at the idea that "*all is now lost, finally, irrecoverably lost!*" He adds, "I will agree with my lady that *the immortality of the soul is, at some times, a very comfortable doctrine.*" The announcement of his death in the public prints, in January, 1794, was accompanied with this remark: "He left this world in gloomy despondency, without those hopes and consolations which cheer the Christian in the prospects of immortality." Dr. A. Smith, in the account he gives of the last illness of *Hume*, the historian, seems to triumph in the fortitude which he manifested in the prospect of his dissolution; and he adduces a playfulness of expression as an evidence of it in his jocular allusion to *Charon* and his boat. But, as Dr. Cogan, in his Treatise on the Passions, very properly remarks, "A moment of vivacity, upon the visit of a friend, will not conduct us to the recesses of the heart, or discover its feelings in the hours of solitude." It is, indeed, altogether unnatural for a man who set so high a value upon his literary reputation, and certainly very unsuitable to the momentous occasion, to indulge in such childish pleasantries as Hume is represented to have done at the moment when he considered himself as just about to be launched into non-existence; and, therefore, we have some reason to suspect that his apparent tranquillity was partly the effect of vanity and affectation. "He has confessed," says Dr. Cogan, "in the most explicit terms, that his principles were not calculated to administer consolation to a thinking mind." This appears from the following passage in his Treatise on Human Nature. "I am affrighted and confounded with that forlorn solitude in which I am placed by my philosophy. When I look abroad, I foresee, on every side, dispute, contradiction, and distraction. When I turn my eye inward, I find nothing but doubt and ignorance. Where am I, or what? From what causes do I derive my existence, and to what condition shall I return? I am confounded with these questions, and begin to fancy myself in the most deplorable condition imaginable, environed with the deepest darkness."*

Diderot, one of the French philosophists, was a man of very considerable acquirements in literature and in the physical sciences. The first publication by which he attracted public notice was a volume written against the Christian religion, entitled *Pensées Philosophiques.* Afterward, in company with Voltaire and D'Alembert, he conducted the publication of the *Dictionnaire Encyclopédique*, the secret object of which was to sap the foundations of all religion, while the reader, at the same time, was presented with the most splendid articles on the belles-lettres, mathematics, and the different branches of physical science. While a weak divine, to whom the theological department of the work was committed, was supporting, by the best arguments he could devise, the religion of his country, Diderot and D'Alembert were overturning those arguments under titles which properly allowed of no such disquisitions; and that the object of these digressions might not pass unnoticed by *any* class of readers, care was taken to refer to them from the articles where the question was discussed by the divine. Here was an example of that *hypocrisy* to which I have already adverted, as characteristic of the sect of infidel philosophers;

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* Treatise on Human Nature, vol. i. p. 458.

and the following anecdote is illustrative of similar disingenuity, coupled with almost unparalleled impudence. In the course of his correspondence with the late Empress of Russia, Diderot mentioned his own library as one of the most valuable in Europe, although it is supposed not to have contained above a hundred volumes. When Catharine wanted to purchase it and make him librarian, he said that his constitution could not support the cold climate of Petersburgh. She offered to let him keep it during his lifetime at Paris; and the library was sold for an immense price. When her ambassador wanted to see it, after a year or two's payments, and the visitation could no longer be put off, he was obliged to run in a hurry through all the booksellers' shops in Germany, to fill his empty shelves with old volumes. It was customary for Diderot and D'Alembert to frequent the coffee-houses of Paris, and to enter with keenness into religious disputes, the former attacking Christianity, and the latter, under the mask of piety, defending it, but always yielding to the arguments of his opponent. This practice was put a stop to by the police; and Diderot, when reproached by the lieutenant for preaching atheism, replied, "It is true, I am an atheist, and I glory in it." But such principles will not always support the mind, nor did they support the mind of Diderot, when his dissolution approached. When he perceived that death was at no great distance, he desired that a priest might be brought, and the cure de St. Sulpice was introduced to him. He saw this ecclesiastic several times, and was preparing to make a public recantation of his errors; but Condorcet and the other adepts now crowded about him, persuaded him that his case was not dangerous, and that country air would restore him to health. For some time he resisted their attempts to bring him back to atheism, but they secretly hurried him to the country, where he died, and a report was spread that he died suddenly on rising from the table, without remorse, and with his atheism unshaken.

Such are the native effects of the highest intellectual accomplishments, and the most brilliant acquirements in science, when unaccompanied with the spirit of true religion and of Christian morality. They cannot improve the moral order of society; they cannot procure for their possessors substantial enjoyment, even in the present life; and they are altogether inadequate to support and tranquillize the soul in the prospect of the agonies of dissolving nature. Notwithstanding the rational gratifications such persons may have occasionally enjoyed in philosophical pursuits, they must be obliged to confess that they have acquired no equivalent for those joys which frequently animate the hearts of the most illiterate, who are sometimes enabled to look forward to the king of terrors without dismay, and to depart in peace with hopes full of immortality,—when the philosophist is obliged to exclaim, "All is now lost, finally and irrecoverably lost." Yet such is the tendency of the principles which are now in operation in our literary and scientific seminaries, and such the result to which we must ultimately look forward, should the principles of religion be discarded from the pursuits of knowledge.

It is therefore to be hoped, that all who have a sincere regard for the promotion of science, for the interests of religion, and for the welfare of their country, will devote a portion of their attention to this important subject, and set their faces in opposition to the spirit of that skeptical philosophy which has so long debased and demoralized the continental philosophists. Were all the instructions delivered in our seminaries, from infant schools through all the gradations of grammar and parochial establishments, mechanics' institutions, academies, and universities, judiciously amalgamated with the principles of pure and undefiled religion, it would doubtless be accompanied with a variety of pleasing and beneficial effects. It would tend to remove the prejudices which a considerable portion of the religious world still entertain against the pursuits of science,—it would lead to correct and rational views of the Christian system, and tend to dissipate those foolish and superstitious notions which have too frequently been grafted upon it,—it would promote the interests of genuine morality among society at large,—it would fit the inferior ranks of the community for taking a part in the elective franchise and government of their country, and the higher ranks for promoting the enactment of laws congenial to the spirit of true religion, and promotive of the best interests of the nation,—it would tend to secure the peace and tranquillity of nations, by undermining the malignant passions from which wars and contentions derive their origin,—it would introduce a general spirit of philanthropy, and give efficacy to the means employed for promoting the knowledge of Christianity throughout the world, and would, ere long, usher in the period foretold in ancient prophecy, when "the knowledge of Jehovah shall cover the earth, as the waters cover the channels of the deep," and "when righteousness and praise shall spring forth before all nations."

APPENDIX.

No. I.—*Ignorance of the Dark Ages.* Page 19.

THE following facts, chiefly extracted from Dr. Robertson's History of Charles V., will show the low state of literature and the deplorable ignorance which characterized the period to which the text refers. In the ninth century, Herbaud Comes Palatii, though supreme judge of the empire, by virtue of his office, could not subscribe his name. As late as the fourteenth century, Du Guesclin, Constable of France, the greatest man in the state, could neither read nor write. Nor was this ignorance confined to laymen—the greater part even of the clergy were not many degrees superior to them in science. Many dignified ecclesiastics could not subscribe the canons of those councils of which they sat as members. One of the questions appointed by the canons to be put to persons who were candidates for holy orders was this—"Whether they could read the Gospels and Epistles, and explain the tenor of them, at least literally?"—Alfred the Great complained that from the Humber to the Thames there was not a priest who understood the liturgy in his mother tongue, or who could translate the easiest piece of Latin; and that from the Thames to the sea the ecclesiastics were still more ignorant. The ignorance of the clergy is quaintly described by Alanus, an author of the dark ages, in the following words: "Potius dediti gulæ quam glossæ; potius colligunt libras quam legunt libros; libentius intuentur Martham quam Marcum; malunt legere in Salmone quam in Solomone,"—*i. e.* They gave themselves more willingly to the pleasures of gluttony than to the learning of languages; they chose rather to collect money than to read books; they looked upon *Martha* with a more affectionate eye than upon Mark; and they found more delight in reading in Salmon than in Solomon.

One of the causes of the universal ignorance which prevailed during that period was the scarcity of books, along with their exorbitant price, and the difficulty of rendering them more common. The Romans wrote their books either on parchment or on paper made of the Egyptian papyrus. The latter, being the cheapest, was of course the most commonly used. But after the communication between Europe and Egypt was broken off, on account of the latter having been seized upon by the Saracens, the papyrus was no longer in use in Italy and other European countries. They were obliged, on that account, to write all their books upon parchment; and as its price was high, books became extremely rare, and of great value. We may judge of the scarcity of the materials for writing them from one circumstance. There still remain several manuscripts of the eighth, ninth, and following centuries, written on parchment, from which some former writing had been erased, in order to substitute a new composition in its place. In this manner, it is probable, several works of the ancients perished. A book of Livy or of Tacitus might be erased to make room for the legendary tale of a saint, or the superstitious prayers of a missal. Many circumstances prove the scarcity of books during these ages. Private persons seldom possessed any books whatever. Even monasteries of considerable note had only one missal. Lupus, Abbot of Ferriers, in a letter to the pope, A. D. 855, beseeches him to send him a copy of Cicero *De Oratore*, and Quintilian's "Institutions"—"For," says he, "although we have part of those books, there is no complete copy of them in all France." The price of books became so high that persons of a moderate fortune could not afford to purchase them. The Countess of Anjou paid for a copy of the Homilies of Hamon, Bishop of Alberstadt, two hundred sheep, five quarters of wheat, and the same quantity of rye and millet. Even so late as the year 1471, when Louis XI. borrowed the works of Racis, the Arabian physician, from the faculty of medicine in Paris, he not only deposited in pledge a considerable quantity of plate, but was obliged to procure a nobleman to join with him as surety in a deed, binding himself under a great forfeiture to restore it. When any person made a present of a book to a church or monastery, in which were the only libraries during several ages, it was deemed a donative of such value, that he offered it on the altar *pro remedio animæ suæ*, in order to obtain the forgiveness of his sins. In the eleventh century, the art of making paper, in the manner now become universal, was invented; by means of which, not only the number of manuscripts increased, but the study of the sciences was wonderfully facilitated.

No. II.—*Foolish and Superstitious Opinions respecting Comets and Eclipses.* Page 31.

Aristotle held comets to be fiery exhalations, rising from the lower atmosphere to the upper or fiery region, condensing during their rapid descent, kindling on their near approach to the empyreum, and burning until exhausted. *Leonard Digges*, an almanac maker of the fourteenth century, affirmed of comets, "That they signifie corruption of the ayre; they are signes of earthquake, of warres, chaunging of kingdomes, great dearth of corne, yea a common death of man and beast."—*Bodin* supposed them spirits, which, having lived on the earth innumerable ages, and having at last completed their term of existence, celebrate their last triumphs, or are recalled to heaven, in the form of shining stars. In the records of former ages, we read of a comet "coming out from an opening in the heavens, like to a dragon with blue feet, and a head covered with snakes." And we are told that "in the year 1527, about four in the morning, not only in the palatinate of the Rhine, but nearly over all Europe, appeared for an hour and a quarter a most horrible comet in this sort. In its length it was of a bloody colour, inclining to saffron. From the top of its train appeared a bended arm, in the hand whereof was a huge sword, in the instant posture of striking. At the point of the sword was a star. From the star proceeded dusky rays, like a hairy tail; on the side of them other rays like javelins, or lesser swords, as if imbrued in blood; between which appeared human faces of the colour of blackish clouds, with rough hair and beards.. All these moved with such terrible sparkling and brightness, that many spectators swooned with fear."—*Rosenburgi*, "*Exampla Cometarum.*"

The comet of 1454, seen at Constantinople, seemed there to be moving in the firmament from west to east, and to present the aspect of a flaming sword. From its great magnitude, it is said even to have eclipsed the moon, and created among the Turks the utmost consternation, as it was thought to prognosticate nothing less than a crusade from all the kingdoms of Christendom, and forbode the certain overthrow of the crescent. Only two years afterward, when, notwithstanding these direful omens, the Turkish arms had proved eminently victorious, and were spreading dismay over all Europe, Halley's comet, in 1456, with a long tail turned towards the east, created reciprocal and still greater alarms on the part of the Christians. Pope Calixtus believed it to be at once the sign and instrument of Divine wrath; he ordered public prayers to be offered up, and decreed that in every town the bells should be tolled at midday, to warn the people to supplicate the mercy and forgiveness of Heaven; "ut omnes de precibus contra Turcarum tyrrannidem fundendis admonerentur." That all people may be admonished to pour out supplications against the tyranny of the Turks.—See Milne's Essay on Comets.

Even in modern times many foolish and preposterous opinions have been entertained respecting these anomalous bodies. In a late periodical publication, the writer of an article on comets, when alluding to the comet of 1811, proceeds to state "some singular changes and circumstances" which its influence occasioned. "The winter," says he, "was very mild, the spring was wet, the summer cool, and very little appearance of the sun to ripen the produce of the earth; yet the harvest was not deficient, and some fruits were not only abundant, but deliciously ripe—such as figs, melons, and wall-fruit. Very few wasps appeared, and the flies became blind, and disappeared early in the season. No violent storms of thunder and lightning, and little or no frost and snow the ensuing winter. Venison, which has been supposed to be indebted for its flavour to a dry and parched summer, was by no means deficient in fat or in flavour. But what is very remarkable," continues this sage observer, "in the metropolis and about it, was the number of females who produced twins: some had more; and a shoemaker's wife, in Whitechapel, produced four at one birth, all of whom," &c. &c. And all such "singular changes and circumstances," it would appear, according to the fancy of this sapient essayist, "were occasioned by the influence of the comet which appeared in the autumn of 1811!!"

The poets, likewise, by their bombastic descriptions, have tended to perpetuate superstitious feelings. The following is Du Barta's description of one of these visiters:

"Here, in the night, appears a flaming spire,
There, a fierce dragon, folded all on fire;
Here, with long bloody hairs, a blazing star
Threatens the world with famine, plague, and war;
To princes death, to kingdoms many crosses;
To all estates inevitable losses;
To herdsmen rot, to ploughmen hapless seasons;
To sailors storms, to cities civil treasons."

The following extract from "Tully's *Letters from Tripoli,*" contains a picturesque description of a *solar eclipse,* and the effects it produced on the inhabitants of Barbary.

"I cannot here omit describing what an extraordinary impression an eclipse makes on the uninformed part of the inhabitants of this country. Of this we had ocular proof during the great eclipse of the sun on the 4th of this month, which was almost total, and occasioned, for some minutes, a gloomy darkness, resembling that of midnight. The beginning of the eclipse was seen at Tripoli at half-past seven in the morning; at half-past eight, when it was at the height, the face of nature was changed from day to night. The screech-owl, not long retired to its rest, reappeared, and disturbed the morning with its shrieks. Lizards and serpents were seen prowling about the terraces; and flights of evening birds, here called marabats, and held sacred by the Moors, flew about in great numbers, and increased the darkness. The noisy flitting of their wings roused the Moor, who had been stupified with fear; and when one of these heavy birds (which often drop to the ground by coming in contact with each other) chanced to fall at his feet, the African would start aghast, look at it with horror, and set up a hideous howl. About eight o'clock, when the lustre of the morning was completely faded, the common Moors were seen assembling in clusters in the streets, gazing wildly at the sun, and conversing very earnestly. When the eclipse was at its height, they ran about distracted in companies, firing volleys of muskets at the sun, to frighten away the monster or dragon, as they called it, by which they supposed it was being devoured. At that moment the Moorish song of death and *walliah-woo*, or the howl they make for the dead, not only resounded from the mountains and valleys of Tripoli, but was undoubtedly re-echoed throughout the continent of Africa. The women brought into the streets all the brass pans, kettles, and iron utensils they could collect; and, striking on them with all their force, and screaming at the same time, occasioned a horrid noise, that was heard for miles. Many of these women, owing to their exertions and fears, fell into fits, or fainted. The distress and terror of the Moors did not in the least abate till near nine o'clock, when the sun assured them, by his refulgent beams, that all his dangers were passed.

"During the morning and the day the atmosphere was uncommonly clear, even for a Barbary sky, which rendered the effects of this great eclipse more striking. We learned from Hadgi Abderrahman, who paid us a visit when it was over, that the first ladies in the place had trembled at the event, and several were seriously ill. The ladies of his own family, he said, had suffered much less at the appearance of the eclipse, from the circumstance of his being at home with them; for though he considered it would be useless to enter into a philosophical account of it to them, yet he assured them that the moon went occasionally to see the sun; and when they met, by their being so close together, the moon always interrupted more or less of his light. This account, he said, the truth of which they were convinced of by his great earnestness, considerably abated their fears. To the ambassador it was a serious case, as Lilla Amnani is in a very delicate state of health; but the account he gave her of the phenomenon entirely pacified her."

The above description presents a melancholy picture of the *gross ignorance* even of the *ladies* of modern Barbary, and of the consequent shallowness of their understandings; since their fathers and husbands considered it useless to enter into a rational account of the phenomenon, and since they were pleased with such an absurd and extravagant explanation of it. And since the higher ranks in that country are so grossly ignorant of the order of nature, and of the causes of so common phenomena, in what a state of mental darkness must the lower classes of society be placed! Nor is Barbary the only country in which such ignorance prevails. Among the middling and lower ranks in many European countries, supposed to be in a moderate state of civilization, a similar degree of intellectual debasement will be found to exist. The Croatians, who inhabit a certain district of the Austrian empire, make the whole of their religion consist in the hearing of mass and the observance of Lent; and robbery or murder are considered as more venial crimes than to eat, during Lent, with a spoon that has been dipped in broth. The Morlacchi, who occupy another district of the same empire, are described by geographers as extremely superstitious in their religious opinions, and as firmly believing in ghosts and witches, in sorceries and enchantments, and in every species of supernatural agency, while they are ignorant of the causes of the most common phenomena of nature.

No. III.—*Absurdities of Astrology.* Page 33, &c.

Mr. Varley's "Zodiacal Physiognomy," referred to in a note, p. 33, pretends to decide that the various signs of the zodiac create a great diversity in the features and complexions of human beings; and have, in fact, such influence over the destinies of the human race, that the system may be fairly styled "the phrenology of the skies." The following extracts exhibit a few specimens of the positions maintained by this *profound* and *erudite* writer. "It has been discovered," says Mr. Varley, "that each sign confers a specific style of countenance, feature, and complexion, by which appearances alone the sign which was rising at the east, at birth, can often, without any other help, be ascertained."—"The fiery trigon, consisting of Aries, Leo, and Sagittarius, contain the spirited, generous, magnanimous, and princely natures; the earthy trigon, Taurus, Virgo, and Capricorn, contain the careful, sordid, and pernicious qualities; the aerial trigon, Gemini, Libra, and Aquarius, contain the humane, harmonious, and courteous principles; and the watery trigon, Cancer, Scorpio, and Pisces, the cold, prolific, cautious, and severe qualities."—"Sagittarius, the house of Jupiter, is the only sign under which no persons are born having black or dark hair, eyes, and eyebrows."—"I have always uniformly found," says the author, "those born under Sagittarius to be very fair, with gray eyes, and, in general, of a lively, forgiving-hearted, and free disposition." Again: "Five minutes' difference of the time of their birth renders the members of the same family red-haired or black-haired, blue-eyed or black-eyed, sordid or generous."—"Saturn, at any period of life, passing through the ascendant, which he does every thirty years, causes dulness or melancholy for a few weeks to the native, and when

Jupiter passes over it, the party feels cheerful and healthy; and should a party of antiquarians, hundreds of years after a person's death, discover his grave, there must be some planet or the sun in conjunction, or some other aspect with his ascendant."—"Jupiter in the third house gives safe inland journeys, and agreeable neighbours or kindred. The moon in this house will give constant trudging from one place to another, and is often so posited in the nativities of postmen and travellers. Jupiter in the fourth, with Venus, gives fixed or landed property, and a house ornamented with matters of taste, or of the fine arts. Jupiter in the fifth gives a family of good or clever children, and much pleasure in life and its amusements. In the sixth he signifies good servants and assistants, good health, and that the native will be fortunate in small cattle and animals. Jupiter in the seventh signifies a good wife or husband, and agreeable dealings with mankind in making good bargains, &c."—"Children born under Mars have *well-formed chins*—under Aquarius, are fair and amiable—under Scorpio, are dark, with *aquiline noses*, and greenish or gray eyes."—"Lord Byron, who was born under Scorpio, received enough of the reflected Taurus principle to prevent his nose from being aquiline, and to give to his character a degree of perverseness or eccentricity"—"Persons born under Aries, with Jupiter in the first house, are likely to succeed and be appreciated in England: if he be posited in Taurus, the native is likely to succeed well in Ireland; if in Gemini, in London, of which this sign is the significator. Jupiter in Cancer will give him success in Scotland or Holland, or concerns connected with the water, unless Jupiter should be afflicted by any *malevolent planet*, or be in combustion by being too near the sun."

By this time the reader will be sufficiently satiated with the sage doctrines of Mr. John Varley, in relation to "Zodiacal Physiognomy" and the phrenology of the heavens. If he has a desire to pick up any more of such precious fragments of wisdom, he will be abundantly gratified in perusing the work itself, where, among other unique and precious relics, he will be presented with an engraving *of the ghost of a flea*, together with an account of the manner in which it appeared to Mr. Blake, the artist, who drew it, and of its astrological correspondency and signification. That such absurdities should be published by the first bookselling establishment in London, in the twenty-eighth year of the nineteenth century, and be purchased by hundreds, perhaps by thousands, is a proof that strong efforts are still requisite to extirpate the superstitions of astrology from the minds of many of our countrymen.

No. IV.—*Proofs of the belief which is still attached to the doctrines of Astrology, and of the pernicious effects it produces.* Page 33.

That the predictions of astrologers are still believed by many of our countrymen in the middling ranks of life appears from the following recent occurrences.

On the 2d September, 1829, Joseph Hyatt, a journeyman printer, was summoned before Sir Peter Laurie, at the Guildhall, London, charged with assaulting his wife Phillips on the preceding Saturday. In his defence, Hyatt declared that all their unhappiness proceeded from his wife (a pretty young woman of eighteen years) continually haunting the fortune-tellers, and paying attention to their predictions. He produced a paper he had recently found, written by an astrologer to whom his wife had applied. After laying down the position of the planets on the 3d of June, at the moment she applied to him, the astrologer proceeds, "The querant must not expect any thing to be very kind to her until late in this year, say October next. This day will not prove any thing kind or pleasant. The 28th day of this month also will not be friendly. July 2d, mind your phunny, and take no journey, and trust to no relative. The 8th day will not be unkind, I hope. Look to it. The 13th day also promises you pleasure and also profit. Attend it; and avoid all dark sallow persons." (Her husband nearly answered this description.) "From such your disappointments must come. August 2, 6, 23, avoid them days—may be qualified to give you vexation; avoid them. Sept. 1, 6, will be unkind—but pray avoid 15, 20. October 4, avoid it—may be vexatious. The 20, 21, 27, 28, 29, 30, will be more kind; pray attend to them, and make good use of them; they will not be unkind." The husband said this fellow had predicted their separation for three months; what other things he had put in her head he did not know, but he led a miserable life with her.—*Morning Chronicle, September 3d,* 1829.

On the same day as above stated (Sept. 2, 1829), Ann Wheeler, a servant girl, was brought to the *Mansion-house*, charged with having attempted to enter the house of her master at two o'clock in the morning, over the rails. She was exquisitely dressed, and wore an elegant satin bonnet, which belonged to her mistress, and put on her curls and finery, in order to attend a "*hop*" in the neighbourhood, and acknowledged that she had been walking for an hour or two up and down the streets in conversation with her friend. In the course of the investigation it was stated that there was found in the corner of her box, wrapped up carefully, a document which might have led to those unseasonable and unfortunate assignations which at last terminated in her being brought to the watch-house. A paper was handed to the lord-mayor, in which was folded a card, on which was written the following words :—

"Mrs. Smith, No. 49 Wentworth Street, Dress-maker."

"Lawful questions resolved."

The paper was an answer to the question, "What sort of a husband shall I have, and how soon shall I have him?" It stated, that the "interrogator should have a nice respectable tradesman, who should be a most tender husband, and be the father of six children, of which she should be the happy mother; *—that certain planets were visible at their birth, and, in conjunction at the time, a symptom that betokened felicity, and that the union should take place as surely as* he *or* she (the person who wrote the paper) *had the power of predicting*."*—Morning Chronicle, Sept. 3d*, 1829.

The above are only specimens of many similar occurrences which are occasionally recorded in the daily papers. The pernicious tendency of astrological predictions on those who are weak enough to give them credit is sufficiently apparent in the cases now stated; having in the one case alienated the affections of a young woman from her husband, and produced contention and family discord; and in the other, tantalized a vain young female, and brought her into suspicious and disgraceful circumstances, which may lay the foundation of her ruin, and render her miserable for life

No. V.—*Illustrations of some of the opinions and practices of our ancestors in relation to Witchcraft.* P. 41.

By *witchcraft* was generally understood,—a supernatural power, of which persons were supposed to obtain the possession, by entering into a compact with the devil. They gave themselves up to him, body and soul; and he engaged that they should want for nothing, and that he would avenge them upon all their enemies. As soon as the bargain was concluded, the devil delivered to the witch an *imp*, or familiar spirit, to be ready at a call, and to do whatever it was directed. By the assistance of this imp, and of the devil together, the witch, who was almost always an old woman, was enabled to transport herself through the air, on a broomstick, or a spit, to distant places to attend the meetings of the witches. At these meetings the devil always presided. They were enabled also to transform themselves into various shapes, particularly to assume the forms of cats and hares, in which they most delighted; to inflict diseases on whomsoever they thought proper, and to punish their enemies in a variety of ways. Witchcraft was universally believed in Europe till the sixteenth century, and maintained its ground with tolerable firmness till the middle of the seventeenth, nay, in some countries on the Continent till the middle of the eighteenth century. Vast numbers of reputed witches were convicted and condemned to be burnt every year. The methods of discovering them were various. One was to weigh the supposed criminal against the church Bible, which, if she was guilty, would preponderate; another, by making her attempt to say the Lord's Prayer,—this no witch was able to repeat entirely, but would omit some part or sentence thereof. It is remarkable that all witches did not hesitate at the same part,—some leaving out one part, and some another. *Teats*, through which the imps sucked, were indubitable marks of a witch; these were always raw, and also insensible, and, if squeezed, sometimes yielded a drop of blood. A witch could not weep more than three tears, and that only out of the left eye. This want of tears was, by the witch-finders, and even by some judges, considered as a very substantial proof of guilt. Swimming a witch was another kind of popular ordeal generally practised. For this she was stripped naked and cross-bound,—the right thumb to the left toe, and the left thumb to the right toe. Thus prepared, she was thrown into a pond or river, in which, if guilty, she could not sink; for having, by her compact with the devil, renounced the benefit of the water of baptism, that element, in its turn, renounced her, and refused to receive her into its bosom. There were two other ordeals by *fire*, by which witches were discovered; the first by burning the thatch of the house of the suspected witch,—the other, by burning any animal supposed to be bewitched by her, as a hog or an ox. These, it was held, would force a witch to confess.

The trial by the *stool* was another method used for the detection of witches. It was thus managed:—Having taken the suspected witch, she was placed in the middle of a room, upon a stool, or table, cross-legged, or in some other uneasy posture, to which, if she did not submit, she was then bound with cords, —there she was watched, and kept without meat or sleep for twenty-four hours (for, they said, that within that time they should see her imp come and suck). A little hole was likewise made in the door for imps to come in at, and, lest it should come in some less discernible shape, they that watched were taught to be ever and anon sweeping the room, and, if they saw any spiders or flies, to kill them,—if they could not kill them, then they might be sure they were imps. If witches, under examination or torture, would not confess, all their apparel was changed, and every hair of their body shaved off with a sharp razor, lest they should secrete magical charms to prevent their confessing. It was a maxim, too, in these proceedings, that witches were most apt to confess on *Fridays*. By such trials as these, and by the accusations of children, old women, and fools, were thousands of unhappy women condemned for witchcraft, and burned at the stake.

A work, written by *M. Thoest*, was published a few years ago at Mentz, entitled, "The History of Magic, Demons, Sorcerers," &c., which contains an affecting narrative of the numbers that have suffered for the pretended crime of magic and witchcraft. The cases enumerated are proved from unequivocal authority. In these excesses of the magistrates, it appears that female sorcerers have been the greatest sufferers. Among other curious articles in the collection, we learn, that Christopher de Runtzow, a gentleman of Holstein, whose heated imagination had misled his understanding, *consigned eighteen persons to the flames at one time*, the victims of a merciless superstition. In a village called Lindheim, containing about six hundred inhabitants, not less than *thirty* were destroyed by fire, in the narrow interval between the years 1661 and 1665, making a twentieth part of the whole population consumed in four years. In this inhuman conduct towards an unhappy class of persons, the author points out Wurtzburg as having frequently been subject to well-merited reproach. It appears from the *Acta Magica* of Naubers, that between the years 1627 and 1629, one hundred and twenty-seven individuals perished in similar instances of cruelty practised by their brother men. The principal objects of such nefarious dealings were old women, or travellers, and frequently poor children, from nine to ten years of age. Occasionally such outrages have been perpetrated on persons of some consequence,—proficients in knowledge above the general standard of the age, or such as had acquired property by their industry and genius. Among many others in these shocking details are the respectable names of fourteen vicars, two young gentlemen, some counsellors, the largest or most corpulent man in Wurtzburg, and his wife the handsomest woman in the city, and a student or scholar engaged in the study of foreign languages. Those innocent sufferers were frequently put to the torture. But what must our feelings and principles incline us to think of an enormity here brought to our recollection, in the instance of a poor girl, Maria Renata, who suffered so late as in the year 1749!

The extent of the judicial murders for witchcraft is far greater than most persons, who have not studied the history of demonology can form any idea. From the period in which Pope Innocent VIII., in 1484, issued his bull against witchcraft, to the middle of the seventeenth century, if we believe the testimonies of contemporary historians, Europe was little better than a large suburb or outwork of Pandemonium, one-half the population being either bewitching or bewitched. Delrio tells us, that five hundred witches were executed in Geneva, in three months, about the year 1515. "*A thousand*," says Bartholomæus de

Spina, "were executed in one year, in the diocess of Como, and they went on burning at the rate of a hundred per annum for some time after." In Lorraine, from 1580 to 1595, Remigius boasts of having burnt nine hundred. In France, the executions for the same crime were fifteen hundred and twenty. In Wurtzburg and Treves, the amount of executions in the course of the century preceding 1628 is reckoned to be 15,700. It has been calculated that in Germany alone, the number of victims that perished, from the date of Innocent's bull to the eighteenth century, considerably exceeds *one hundred thousand.* The executions were at first confined to crazed old women, or unhappy foreigners, but at length the witchcraft phrensy rose to such a pitch, and spread so extensively, that the lives of more exalted victims were threatened. Noblemen and abbots, presidents of courts and professors, began to swell the catalogue, and no man felt secure that he might not suddenly be compelled, by torture, to bear witness against his own innocent wife and children. In the Catholic canton of *Glarus*, in Switzerland, it is said that a witch was burnt even so late as the year 1786! It is impossible for any rational and humane mind to peruse such a list as the above without shuddering and horror. How dreadful the results to which ignorance and superstition have led!—and how astonishing the consideration,—that judges, lawyers, ministers of religion, nobles, and persons of all ranks should have given their sanction, without the least remorse, to such cruelties and legalized murders!

In Pitcairn's "Criminal Trials," referred to in the text, a variety of curious documents is contained, respecting the proceedings of the Justiciary Court in Scotland against witchcraft, sorcery, and incantation. One of these trials relates to a gentleman of family, Mr. Hector Monro of Fowies, who was "indytit and accuseit" of "sorcerie, incantationnis, or wichecraft." This trial contains a complete specimen of the superstition of the age. Mr. Hector, it would appear, had sent for "Johne M'Connielly-gar and his wyffes, and Johne Bunes wyffe, in Lytell Alteis, thre notorious and commoune wiches." They had been sent for to assist in restoring the health of Robert Monro, a brother of the said Mr. Hector, who entertained them for five days. It is said in the indictment, that they "poillit the hair of Robert Monro, his brotheris head, and plait the naillis of his fingeris and tais," and "socht be thair develisch meanes to have cureit him of his sickness;" but it would appear, that the *weird sisters* were by no means successful, and were compelled to decamp, for "they wald haif vsit furth the rest of thair develisch craft was nocht they ferit to tarie with him (Hector Monro), be ressone of his fader, quha wald haif apprehendit thame; and they declarit to him that he was owre lang in sending for thame, swa that they cald do na guid to the said Robert Monro." Mr. Hector, however, fell sick himself, and had recourse to the hags for a cure; and as he had an eye to the patrimony of his father, to which he could not succeed, as he was a younger son, he began some incantations, in concert with the hags, to deprive his elder brother, George Monro, of life, and for this he was "delatit," also of "slaughter." The indictment, which is a most remarkable document, is too long for insertion. Jonett Grant, Jonett Clark, and Bessie Roy, nurse to the "Laird of Boquhave," are the three next ladies who were called to account for being "fylit" of witchcraft. The two *Jonetts* seem to have been in partnership; and if the indictments are to be credited, they were guilty of no fewer than six "crewal murthers," by witchcraft, of the "slavchter and destructionne of saxtene heid of nolt, of raising the devil, of making men *eunuchs* by witchcraft," &c. For such hardened sinners as the two *Jonetts* no mercy was to be expected, and accordingly they were condemned to be "tane to the Castle hill of Edinburgh, and there werriet at ane staik, and their body to be burnt to assis." Bessie Roy, however, came off with flying colours, although she was also indicted as "ane commoune thief," by means of the "enchantment and slicht of the diuill." —The following is the title of a pamphlet, republished by Mr. Pitcairn, containing a most extraordinary narrative. "Newes from Scotland, declaring the damnable life of *Doctor Fean*, a notable sorcerer, who was burned at Edinburgh in Januarie last, 1591, which doctor was register to the deuill, that sundrie times preached at North Barricke kirk to a number of notorious witches, &c." The poor woman, who was most cruelly treated, was Euphane Mackalsane, a notable witch, who appears to have been so notorious as to be "bound to ane staik, and brunt to assis, *quick* to the death." "This," says Mr. Pitcairn, "was the severest sentence ever pronounced by the court, even in the most atrocious cases," but poor Euphane died, nevertheless, with all the heroism and devotedness of a martyr. See *Edin. Lit. Gaz.*, July, 1829.

To attempt a serious refutation of the doctrines of witchcraft would be altogether superfluous and even ridiculous. That there ever were witches, that is, persons endowed with such powers as are usually ascribed to witches, is what no rational and enlightened mind can for a moment admit. The actions imputed to them are either absurd or impossible. To suppose an ignorant old woman, or indeed any human being, capable of transforming herself into a cat or a hare, is to suppose her capable of counteracting the laws of nature, which is competent to none but the Supreme Ruler of the world. We might almost as soon believe that such a being is capable of creating the universe. It presents a most humiliating picture of the imbecility of the human mind, that such absurdities should ever have been believed; and certainly conveys no very favourable idea of the *humanity* of our ancestors, when they inflicted, without remorse, so many shocking cruelties, especially on the tender sex, for such fancied crimes. Yet, absurd as the doctrine of witchcraft certainly is, it is a lamentable fact, that vast multitudes of our fellow-men, both in our own country and in other lands, are still believers in sorcery and witchcraft, of which an instance or two is stated in the following note.

No. VI.—*Proofs that the belief in Witchcraft is still prevalent among certain classes of society.*

Notwithstanding the degree of information which prevails in the nineteenth century, it is a melancholy consideration that superstition and a belief in the efficacy of certain incantations *still* prevail to a considerable extent, even in the most enlightened countries. The following recent occurrences will tend to corroborate this position, and at the same time show the pernicious consequences which frequently result from such a belief.

On the 2d September, 1829, Laurent Raimboult, a farmer in the hamlet of Redoire, Commune of Champtre, in France, spent the day in measuring wheat at the house of Poirier, his brother-in-law. About eight o'clock in the evening, he left to go to his own house, which was about half a league from Poirier's house. He carried a bag containing the measure he had been using, and a box holding his dinner, which he had not opened; for he had stated his intention not to eat till he returned home. The next morning his corpse was found in a meadow, bordered by a wood, and not very far from his own house. His body was horribly mutilated, his clothes stained with blood, and there was a large wound on the back part of his head. All the wounds showed that he had been struck by several persons armed with contusive weapons. Near him the ground had not been trod upon; his bag and the things it contained were carefully laid by his side; all proved *that he* had not been robbed. Poirier, who has always had a good character in that part of the country, was on very bad terms with Raimboult, who passed for a *sorcerer*. Some time ago, the wife of Poirier had fallen sick, as well as several of his cattle. Poirier did not doubt for an instant that these sicknesses were the effect of sorcery. He came to Angers, and consulted a pretended diviner, a miserable victim of monomania, who gave him a full water-bottle, and told him to take it home with him, and put it in the very best place of his house. "At such an hour," said the diviner, "you should recite such and such prayers before my water-bottle, and then you will see in the water it contains the likeness of him who has bewitched your wife and your cattle." Poirier followed these orders precisely; and it is only too probable that his imagination being pre-occupied with the idea, this wretched man fancied he saw his brother-in-law in the water-bottle of the guilty diviner, and thought he was doing a service to his country in delivering it from a being whom he regarded as the friend and favourite of the devil.—*Copied from a Paris paper, in Morning Chron., Sept.* 23, 1829.

The following occurrence, in another department of France, happened nearly about the same time as the preceding.

"It appears that in the department of Lot and Garonne, and particularly in some of the communes of the district of Marmande, the belief of sorcery is common among the people. John Sabathe, a peasant with plenty of money, living in the vicinity of Clairac, had a sick daughter: medicine had failed, which is nothing extraordinary; but there remained magic, and Sabathe greatly relied upon it. He applied to Rose Peres, who enjoyed the reputation of being a witch. He stated the condition of his daughter; the witch replied she would go and visit her. She went the next morning to Sabathe's residence, saw the sick girl, and declared she was bewitched. [Perhaps she was not so far wrong either, for some witnesses, who were no doubt very spiteful, gave it as their opinion that love had entered a little into this affair.] Whatever was the cause of her illness, the witch promised to relieve her, and said, that the thing was not without a remedy. She told them to light a great fire, and they would see why afterward. Little as we are initiated into the secrets of magic, we know that *odd* numbers, especially the number *three*, have singular virtues; therefore 3 multiplied by 3 must be a number prodigiously powerful. It was apparently for this reason that the witch required *nine* large pebble stones, which she put into the fire, and kept there till they were red hot: she then threw them into a kettle full of water, and the mysterious vapour that arose served to perfume the patient that was lying over it. But this was only the preamble of ceremonies much more important. She had a table brought to her; it was covered with a cloth, and two lighted candles placed on it; there was even an end of wax that had been used in the church; a hammer was placed symmetrically between the two candles, and on one side of the table the witch laid, with a grave and mysterious air, the formidable book of magic, so well known by the name of Little Albert. She still wanted one thing; it was a plate filled with water, in which a sum of 400 francs (16*l.* sterling) was to be deposited. The plate was brought; as to the sum, we may remark how difficult magic must be to practise, and what attention is requisite to its details. Crown-pieces of six francs were about to be put into the water, when the witch called out, 'Take care what you are doing; it is crown-pieces of *five* francs that are wanted.' She was instantly obeyed,—the crowns of five francs are at the bottom of the plate.

"Things being in this state, everybody left the house. The witch remained alone for about half an hour; she then reopened the doors, and said they might re-enter. She added, that all had succeeded, but that the malignant spirit that had appeared had carried away the 400 francs on withdrawing. The witch's husband then arrived; his wife told him that the assembly was made. 'It's all well,' said he; 'but thy sister is at thy house, and she wants to see you, and we must go there.' They went accordingly; Sabathe and his family a little stupified, and the patient in the same state as before. These were the facts which were made known to the court by indirect evidence, for these good folks took care to make no complaint, for fear of the witches. The court sentenced her to imprisonment for three years, and a fine of fifty francs. She had been charged before the Royal Court of Agen for swindling, under pretence of practising witchcraft. Some years ago, the same court sentenced to close imprisonment three or four women, living in the neighbourhood of Villereal, for having put on the fire and half-burned a pretended witch, who would not cure them of a disease she had given them."—*Gazette des Tribunaux*, as quoted in *Morn. Chron.*, Sept. 28, 1829.

In both the above cases we perceive an implicit belief in the powers of divination and sorcery, a belief which appears to be general among the lower ranks of society; and it would appear that the profession of witch or sorcerer is pretty common in the principal towns in France. In the one instance this belief led to a most atrocious murder, and in the other to a dexterous robbery; and in this latter case, it would seem, that, notwithstanding the palpable imposture that was practised on Sabathe and his family, these simple people still believed in the supernatural powers of the sorceress who had so barefacedly robbed them, for "they took care to make no complaint, *for fear of the witches*."—Nearly akin to the notions under consideration is the following superstition relating to *bees*.

The practice of informing bees of any death that takes place in a family is well known, and still prevails among the lower orders in England. The disastrous consequences to be apprehended from non-compliance with this strange custom is, that the bees will dwindle and die. The manner of communicating the intelligence to the little community, with due form and ceremony, is this—to take the key of the house, and knock with it three times against the hive, telling the inmates, at the same time, that their master or mistress, &c. (as the case may be) is dead! Mr. Loudon says, when in Bedfordshire lately, we were informed of an old man who sung a psalm last year in front of some hives which were not doing well, but which, he said, would thrive in consequence of that ceremony.—*Magazine of Nat. Hist. for* 1828.

The *Constitutionnel* (January, 1828) states, that under the influence of the Jesuits, and with the countenance of the authorities, &c., the most brutifying tales of superstition and fanaticism are printed and circulated in the provinces of France. One of the ridiculous naratives to which it alludes details the fate of a blaspheming baker, who, being infected with the heresies of the Revolution, had addicted himself to the commission of every kind of impiety. While his oven one day was heated, and he was about to put the bread into it, he vented his usual oaths in the presence of two neighbours; when, lo! the dough miraculously refused to enter, and the baker was seized with a cold shivering, of which he died in two days. In his will he left 600 francs to the church, confessed his enormities, and besought the prayers of his friends. In another, we are told of the discovery of a miraculous image, which will be a permanent source of ecclesiastical revenue. This image is that of a saint, which has been for the last two centuries concealed in a rock. It was discovered by means of a little white bird perched upon a brilliant crucifix, which guarded the spot. Since the discovery, the lame walk, the sick are healed, and the blind recover their sight, by resorting to the consecrated ground.

It is not above fifteen or sixteen years ago since the late Alexander Davidson, A.M., lecturer on experimental philosophy and chymistry, when in Ireland, was much annoyed by the superstitious belief in necromancy and infernal agency which still prevails among a large portion of the lower orders in that country. When delivering a course of lectures in a small town not far from Londonderry, the rumour of the experiments he performed spread among the body of the people, many of whom had listened at the outside of the hall in which he lectured, to the loud detonations produced by electrical and other experiments, particularly the explosions of hydrogen gas. The great majority of the inhabitants believed he was an astrologer and necromancer, and considered it dangerous to have the slightest intercourse with his family, even in the way of buying and selling. One morning his servant-maid was sent out for bread and groceries for breakfast. After a considerable time, she returned with a pitiful countenance and a heavy heart, and declared that not an article of any description could be obtained. "What," says Mr. D., "is there no tea, sugar, or bread in the whole village?"—"O yes," replied the maid, "there is plenty of every thing we want, but nobody will sell us an article; they say we are all witches and wizards and necromancers, and *it's no canny to tak ony o' your money*." Mr. Davidson and family, in this case, might have starved, had he not bethought himself of employing the servant of an acquaintance, who was one of his auditors, to procure, in her master's name, the requisite provisions; and this plan he was obliged to adopt during the remainder of his stay in that place. At another time his boots required to be repaired; the servant took them to a shoemaker, and they were received by one of the female branches of his family; but when the shoemaker understood to whom they belonged, he stormed, and was indignant at their receiving any thing from such a dangerous individual. The servant soon after returned to inquire if the boots were repaired. "Is the *astrologer's* boots mendit?" one of the family vociferated. "No," was the reply, "they are not mendit, nor do we intend to mend them, or have any thing to do with them." The shoemaker's wife desired the servant to come in, and *lift the boots herself;* "for," said she, "I will not *touch* them;" and it appears that both the shoemaker and his family had been afraid even to put their fingers upon them, and doubtless imagined that the very circumstance of their having been received into the house would operate as an *evil omen.* On the day previous to his leaving that place, he sent his servant to engage a chaise to carry them to the next town. The servant told the landlady of the inn (which was the only one from which a carriage could be procured) that her master wished to hire a chaise for to-morrow to carry them to N——. The landlady told her it could not be granted. "For what reason?" said the maid. "*You know very well what is the reason,*" said the landlady, in a very emphatical tone. After the servant returned with this reply, Mr. Davidson himself went to the inn, when the following dialogue took place between him and the landlady:—"Well, madam, can you give me a chaise to-morrow to carry me to Newry?"—"No; for our horses are very tired, as they have been out all day, and they cannot go to-morrow."—"O dear, madam, is that the only reason? You know very well *I can make them go.*" The landlady, putting on a grave countenance, replied with emphasis, "*We all know that very well.* We know that you could *sink the town*, if you chose to do it. But I shall give you the chaise, to carry you out of the place, and make the town rid of you; but it is more for *fear* of you than *love* to you that I consent to grant you my chaise." Such were the absurd and superstitious notions prevalent among the lower class of the Irish in 1814 or 1815; and these were not the only instances in which they were manifested, but only specimens of what frequently occurred in other parts of that country.

However clearly persons of education and intelligence may perceive the absurdity and futility of the superstitious notions and practices to which I have now referred, it is a fact well known to those who have been conversant among the lower orders of society, that they still prevail to a very considerable extent among the untutored ranks, even of our own country.

Nothing but a more assiduous cultivation of the rational powers, and a universal diffusion of useful knowledge among the inferior classes of society, can be expected thoroughly to undermine and eradicate such opinions, and to prevent the baneful and pernicious consequences to which they lead.

No. VII.—*Circumstances which have occasionally led to the belief of Spectres and Apparitions.* Page 45.

It is certain that indistinct vision and optical illusions have, in many instances, been the sources of terror, and have produced a belief of supernatural appearances. When we have no other mode of judging of an unknown object but by the angle it forms with the eye, its magnitude will uniformly increase in proportion to its nearness. If it appears when at the distance of forty or fifty paces to be only a few feet high, its height when within three or four feet of the eye, will appear to be above forty times greater, or many fathoms in dimension. An object of this kind must naturally excite terror and astonishment in the spectator till he approaches and recognises it by actual feeling; for the moment a man knows an object, the gigantic appearance it assumed in the eye instantly diminishes, and its apparent magnitude is reduced to its real dimensions. But if, instead of approaching such an object, the spectator flies from it, he can have no other idea of it but from the image which it formed in the eye; and in this case he may affirm with truth, that he saw an object terrible in its aspect and enormous in its size. Such illusions frequently occur when persons are walking through desert and unfrequented tracts of country, surrounded with a fog, or in the dusk of the evening, when a solitary tree, a bush, an old wall, a cairn of stones, a sheep, or a cow may appear as phantoms of a monstrous size. The writer of an article in the "Encyclopædia Britannica" states that "he was passing the Frith of Forth at Queensferry one morning which was extremely foggy. Though the water is only two miles broad, the boat did not get within sight of the southern shore till it approached very near it; he then saw, to his great surprise, a large perpendicular rock, where he knew the shore was low and almost flat. As the boat advanced a little nearer, the rock seemed to split perpendicularly into portions, which separated at little distances from one another; he next saw these perpendicular divisions move, and upon approaching a little nearer, found it was a number of people standing on the beach, waiting the arrival of the ferry-boat."

Spectres are frequently occasioned by opium. Gassendi, the philosopher, found a number of people going to put a man to death for having intercourse with the devil—a crime which the poor wretch readily acknowledged. Gassendi begged of the people that they would permit him first to examine the wizard, before putting him to death. They did so, and Gassendi, upon examination, found that the man firmly believed himself guilty of this impossible crime; he even offered to Gassendi to introduce him to the devil. The philosopher agreed, and when midnight came, the man gave him a pill, which he said it was necessary to swallow before setting off. Gassendi took the pill, but gave it to his dog: the man, having swallowed his, fell into a profound sleep, during which he seemed much agitated by dreams; the dog was affected in a similar manner. When the man awoke he congratulated Gassendi on the favourable reception he had met with from his sable highness. It was with difficulty Gassendi convinced him that the whole was a dream, the effect of soporific medicines, and that he had never stirred from one spot during the whole night.

Drunkenness has also the power of creating apparitions. Drunkenness seldom or never excites fear; and therefore it may at first sight seem strange that persons should imagine they see ghosts when under the influence of intoxication. But it is observable that the ghosts which the drunkard imagines he sees, he beholds not with the same terror and alarm as men that are sober; he is not afraid of them; he has the courage to converse with them, and even to fight them, if they give him provocation. Like Burns's "Tam o' Shanter," give him "fair play—he cares na' de'ils a bodle." A man, returning home intoxicated, affirmed that he had met with the devil; and that, after a severe encounter, he had vanquished him and brought him to the ground, to which he had nailed him fast by driving his staff through his body. Next morning the staff was found stuck with great violence into a heap of turfs!

Dreams may be considered as another source of apparitions. While the mind is under the influence of a dream, it considers it as much a reality as it does any particular action when awake; and, therefore, if a person of a weak superstitious mind should have a very lively dream which interests his passions, it may make so deep an impression that he may be firmly convinced he has actually seen with his eyes what has only passed before his imagination; especially when we consider that there are times of slumber when we are not sensible of being asleep. On this principle, some have endeavoured to account for the spectre which is said to have appeared to Brutus. It is related, that at Philippi, the night before he gave battle to Augustus Cæsar, he saw a fearful apparition; it was in the dead of night, when the whole camp was perfectly quiet, that Brutus was employed in his tent, in reading by a lamp that was just expiring; on a sudden he thought he heard a noise as if somebody entered, and looking towards the door, he perceived it open; a gigantic figure, with a frightful aspect, stood before him, and continued to gaze upon him with silent severity. At last Brutus had courage to speak to it: "Art thou a demon or a mortal man? and why comest thou to me?" The phantom is said to have replied, "Brutus, I am thy evil genius; thou shalt see me again at Philippi."—"Well, then," answered Brutus, without being discomposed, "we shall meet again;" upon which the phantom vanished, and Brutus, calling to his servants, asked them if they had seen any thing; to which replying in the negative, he again resumed his studies. This circumstance is related by historians as a *vision*; but, considering the circumstances, one may easily judge it to have been but a short dream: for, sitting in his tent, pensive and troubled with the horror of his late rash act, it was not hard for him, slumbering in the cold, to dream of that which most affrighted him; which fear, as by degrees it made him wake, so it must have made the apparition by degrees to vanish; and having no assurance that he slept, he could have no cause to think it a dream, or any thing else than a vision. Whatever may be said as to this solution of the case, certain it is that vivid dreams, in certain states of mind, have been mistaken for real apparitions, of which various instances could be adduced, did our limits permit.

Fear is another fertile source of spectres. As partial darkness and obscurity are the most common circumstances by which the sight is deceived, so night is the season in which apparitions are most frequently said to be seen. The state of the mind at that time, especially when a person is alone, prepares it for the admission of such delusions of the imagination. The fear and caution which night naturally inspires, the opportunity it affords for ambuscades, robberies, and assassinations, the deprivation of social intercourse, and the interruption of many pleasing trains of ideas which objects in the light never fail to produce, are all circumstances of terror, and favourable to the illusions of a timid imagination; and therefore it is by no means strange that an ignorant person, with a mind uncultivated and uninformed, and with all the prejudices of the nursery about him, should imagine he sees ghosts in those places where he believes they hover, especially at the hour of midnight, when the slightest aid of the imagination can transform a cow into a monstrous phantom, and the reflection of the beams of the moon from a little water into a ghost with a winding-sheet; or a sound which is near, such as the rustling of the leaves of a tree, the noise of falling waters, or the screams of animals, when referred to a great distance, may be magnified into horrid and unearthly voices; for, in such cases, a timid and untutored mind seldom stops to inquire into the cause of its alarms. The celebrated historian De Thou had a very singular adventure at Saumur, in the year 1598, which shows the happy effects of a calm inquiry into the cause of any alarming or extraordinary appearance.

One night, having retired to rest very much fatigued, while he was enjoying a sound sleep, he felt a very extraordinary weight upon his feet, which, having made him turn suddenly, fell down and awakened him. At first he imagined that it had been only a dream; but hearing soon after some noise in his chamber, he drew aside the curtains, and saw, by the help of the moon, which at that time shone very bright, a large white figure walking up and down, and at the same time observed upon a chair some rags, which he thought belonged to thieves who had come to rob him. The figure, then approaching his bed, he had the courage to ask it what it was. "I am," said the figure, "the Queen of Heaven." Had such a figure appeared to any credulous ignorant man, he would doubtless have trembled with fear, and frightened the whole neighbourhood with a marvellous description of it. But De Thou had too much understanding to be so imposed upon. On hearing the words which dropped from the figure, he immediately concluded that it was some mad woman, got up, called his servants, and ordered them to turn her out of doors; after which he returned to bed and fell asleep. Next morning he found that he had not been deceived in his conjecture, and that having forgot to shut his door, this female figure had escaped from her keepers, and entered his apartment. The brave Schomberg, to whom De Thou related his adventure some days after, confessed that in such a case he would not have shown so much courage. The king likewise, who was informed of it by Schomberg, made the same acknowledgment.—See Ency. Brit., Art. *Spectre.*

The following relation contains a description of an apparition of a different kind, no less appalling. Mr. Schmidt, mathematical teacher at the school of Pforte, near Naumburg, which had formerly been a cloister, once happened to awake suddenly as the morning began to dawn. On opening his eyes, he beheld with astonishment a monk standing at the foot of his bed. Looking at him steadfastly, he appeared to be well-fed; and his head, far from small, was sunk a little between a pair of very broad shoulders. The chamber was sufficiently secured; Mr. Schmidt alone slept in it; and he was very certain that no one would attempt to put a trick upon him in jest. He knew also that no part of his clothes or any thing else was hanging at his bed's foot. The figure exactly resembled that of a monk, clothed in a white surplice, the falling folds of which were very clearly to be distinguished. Had an ignorant and timid man beheld this appearance, he would probably have covered himself up with the bed-clothes, and firmly maintained that the ghost of a monk had appeared to him. As the school had formerly been a cloister, many monks had been buried both in the church and church-yard, and it was currently reported among the vulgar that the place was haunted. Mr. Schmidt, however, was neither ignorant nor timid, and he immediately conjectured that his eyes were deceived, though he could not imagine in what manner. He raised himself up a little in his bed, but the apparition did not move; he only saw somewhat more of it, and the folds of the surplice were still more conspicuous. After a little while he moved towards the right, yet the apparition remained, and he seemed to have in part a side view of it; but as soon as he had moved his head so far as to have a slight glimpse of the bed's foot, the apparition retreated backwards, though still with its face to the bed. Following the apparition quickly with his eyes, it retreated with speed, swelled as it retreated to a gigantic form, a rustling noise was heard, and—at once the apparition was changed into the gothic window with white curtains which was opposite the bed's foot, and about six or seven feet distant from it. Several times after this, Mr. Schmidt endeavoured when he awoke to see the same appearance, but to no purpose, the window always looking like a window only. Some weeks after, however, on awaking, as the day began to dawn, he again perceived the monk's apparition at the bed's foot. Being now aware what occasioned it, he examined it narrowly. The great arch of the window formed the monk's shoulders, a smaller arch in the centre of this bis head, and the curtains the surplice. The folds of these appeared much stronger than they did at the same distance by daylight. Thus the figure of the monk appeared plainer, nearer, and smaller than the window would have done. This apparition, therefore, like hundreds of others, was merely an optical deception. The reader will find a more particular description of it, with an optical and mathematical explanation of the phenomenon, in vol. i. of "The Pleasing Preceptor," translated from the German of Gerhard Ulrich Anthony Vieth.

Another cause of apparitions, and of the belief in supernatural appearances, is to be found *in the artifices and collusions of impostors, and the tricks of the waggish.* Dr. Plot, in his Natural History of Oxfordshire, relates a marvellous story which will illustrate this position. Soon after the murder of King Charles I. a commission was appointed to survey the king's house at Woodstock, with the manor, park, woods, and other demesnes belonging to that manor. One Collins, under a feigned name, hired himself as secretary to the commissioners, who, upon the 13th October, 1649, met, and took up their residence in the king's own rooms. His majesty's bed-chamber they made their kitchen, the council-hall their pantry, and the presence-chamber was the place where they met for the despatch of business. His majesty's dining-room they made their wood-yard, and stored it with the wood of the famous royal oak from the High Park, which, that nothing might be left with the name of king about it, they had dug up by the roots, and split and bundled up into fagots for their firing. Things being thus prepared, they sat on the 16th for the despatch of business; and, in the midst of their first debate, there entered a large *black dog* (as they thought), which made a dreadful howling, overturned two or three of their chairs, and then crept under a bed and vanished. This gave them the greater surprise as the doors were kept constantly locked, so that no real dog could get in or out. The next day their surprise was increased when, sitting at dinner in a lower room, they heard plainly the noise of persons walking over their heads, though they well knew the doors were all locked, and there could be nobody there. Presently after, they heard also all the wood of the king's oak brought by parcels from the dining-room, and thrown with great violence into the presence-chamber, as also all the chairs, stools, tables, and other furniture forcibly hurled about the room; their papers, containing the minutes of their transactions, were torn, and the ink-glass broken. When all this noise had ceased, Giles Sharp, their secretary, proposed to enter first into these rooms; and in presence of the commissioners, from whom he received the key, he opened the doors, and found the wood spread about the room, the chairs tossed about and broken, the papers torn, but not the least track of any human creature, nor the least reason to suspect one, as the doors were all fast, and the keys in the custody of the commissioners. It was therefore unanimously agreed that the power that did this mischief must have entered at the key-hole. The night following, Sharp, the secretary, with two of the commissioners' servants, as they were in bed in the same room, which room was contiguous to that where the commissioners lay, had their beds' feet lifted up so much higher than their heads, that they expected to have their necks broken, and then they were let fall at once with so much violence as shook the whole house, and more than ever terrified the commissioners. On the night of the 19th, as they were all in bed in the same room for greater safety, and lights burning by them, the candles in an instant went out with a sulphurous smell, and that moment many trenchers of wood were hurled about the room, which next morning were found to be the same their honours had eaten out of the day before, which were all removed from the pantry, though not a lock was found opened in the whole house. The next night they fared still worse; the candles went out as before, the curtains of their honours' beds were rattled to and fro with great violence, they received many cruel blows and bruises by eight great pewter dishes and a number of wooden trenchers being thrown on their beds, which, being heaved off, were heard rolling about the room, though in the morning none of these were to be seen.

The next night the keeper of the king's house and his dog lay in the commissioners' room, and then they had no disturbance. But on the night of the 22d, though the dog lay in the room as before, yet the candles went out, a number of brickbats fell from the chimney into the room, the dog howled piteously, their bed-clothes were all stripped off, and their terror increased. On the 24th they thought all the wood of the king's oak was violently thrown down by their bedsides; they counted sixty-four billets that fell, and some hit and shook the beds in which they lay; but in the morning none was found there, nor had the door been opened where the billet-wood was kept. The next night the candles were put out, the curtains rattled, and a dreadful crack, like thunder, was heard; and one of the servants, running in haste, thinking his master was killed, found three dozen of trenchers laid smoothly under the quilt by him. But all this was nothing to what succeeded afterward. The 29th, about midnight, the candles went out, something walked majestically through the room, and opened and shut the windows; great stones were thrown violently into the room, some of which fell on the beds, others on the floor; and at about a quarter after one, a noise was heard as of forty cannon discharged together, and again repeated, at about eight minutes' interval. This alarmed and raised all the neighbourhood, who, coming into their honours' room, gathered up the great stones, fourscore in number, and laid them by in the corner of a field, where, in Dr. Plot's time, they were to be seen. This noise like the discharge of cannon was heard over the country for several miles round. During these noises the commissioners and their servants gave one another over for lost, and cried out for help; and Giles Sharp, snatching up a sword, had wellnigh killed one of their honours, mistaking him for the spirit, as he came in his shirt from his own room to theirs. While they were together the noise was continued, and part of the tiling of the house was stripped off, and all the windows of an upper room were taken away with it. On the 30th, at midnight, something walked into the chamber, treading like a bear; it walked many times about, then threw the warming-pan violently on the floor; at the same time a large quantity of broken glass, accompanied with great stones and horse bones, came pouring into the room with uncommon force. On the 1st of November the most dreadful scene of all ensued. Candles in every part of the room were lighted up, and a great fire made; at midnight, the candles all yet burning, a noise like the bursting of a cannon was heard in the room, and the burning billets were tossed about by it even into their honours' beds, who called Giles and his companions to their relief, otherwise the house had been burned to the ground: about an hour after, the candles went out as usual, the crack as of many cannon was heard, and many pailfuls of green stinking water were thrown upon their honours' beds; great stones were also thrown in as before, the bed-curtains and bedsteads torn and broken; the windows shattered, and the whole neighbourhood alarmed with the most dreadful noises; nay, the very rabbit-stealers that were abroad that night in the warren were so terrified that they fled for fear, and left their ferrets behind them. One of their honours this night spoke, and *in the name of God asked what it was, and why it disturbed them so.?* No answer was given to this; but the noise ceased for a while, when the spirit came again; and, as they all agreed, *brought with it seven devils worse than itself.* One of the servants now lighted a large candle, and set it in the doorway between the two chambers, to see what passed; and, as he watched it, he plainly saw a hoof striking the candle and candlestick into the middle of the room, and afterward making three scrapes over the snuff, scraped it out. Upon this the same person was so bold as to draw a sword; but he had scarce got it out when he felt another invisible hand holding it to, and pulling it from him, and at length prevailing, struck him so violently on the head with the pummel that he fell down for dead with the blow. At this instant was heard another burst like the discharge of the broadside of a ship of war, and at the interval of a minute or two between each, no less than nineteen such discharges. These shook the house so violently that they expected every moment it would fall upon their heads. The neighbours, being all alarmed, flocked to the house in great numbers, and all joined in prayer and psalm-singing; during which the noise continued in the other rooms, and the discharge of cannons was heard as from without, though no visible agent was seen to discharge them. But what was the most alarming of all, and put an end to their proceedings effectually, happened the next day, as they were all at dinner, when a paper in which they had signed a mutual agreement to reserve a part of the premises out of the general survey, and afterward to share it equally among themselves (which paper they had hid for the present under the earth in a pot in one corner of the room, and in which an orange-tree grew), was consumed in a wonderful manner by the earth's taking fire with which the pot was filled, and burning violently, with a blue flame and an intolerable stench, so that they were all driven out of the house, to which they could never be again prevailed upon to return.

This story has been somewhat abridged from the Encyclopædia Britannica, where it is quoted from Dr. Plot's history. If I recollect right, it is imbodied in the book entitled "Satan's Invisible World Discovered," and the extraordinary occurrences it relates ascribed to satanic influence. At the time they happened, they were viewed as the effects of supernatural powers; and even Dr. Plot seems disposed to ascribe them to this cause. "Though many tricks," says the doctor, "have been often played in affairs of this kind, many of the things above related are not reconcileable with juggling; such as the loud noises beyond the powers of man to make without such instruments as were not there—the tearing and breaking the beds—the throwing about the fire—the hoof treading out the candle—and the striving for the sword, and the blow the man received from the pummel of it." It was at length ascertained, however, that this wonderful contrivance was all the invention of the memorable Joseph Collins of Oxford, otherwise called *Funny Jo*, who, having hired himself as secretary under the name of *Giles Sharp*, by knowing the private traps belonging to the house, and by the help of *pulvis fulminans* and other chymical preparations, and letting his fellow-servants into the scheme, carried on the deceit without discovery to the very last.

Ventriloquism is another source whence a belief of apparitions has been induced. By this art, certain persons can so modify their voice as to make it appear to the audience to proceed from any distance and in any direction, and by which impostors have sometimes accomplished their nefarious designs, of which the following are instances.

Louis Brahant, a dexterous ventriloquist, valet-de-chambre to Francis I., had fallen desperately in love with a young, handsome, and rich heiress; but was rejected by the parents as an unsuitable match for their daughter, on account of the lowness of his circumstances. The young lady's father dying, he made a visit to the widow, who was totally ignorant of his singular talent. Suddenly, on his first appearance in open day, in her own house, and in the presence of several persons who were with her, she heard herself accosted in a voice perfectly resembling that of her dead husband, and which seemed to proceed from above, exclaiming, "Give my daughter in marriage to Louis Brahant. He is a man of great fortune, and of an excellent character. I now suffer the inexpressible torments of purgatory for having refused her to him. If you obey this admonition, I shall soon be delivered from this place of torment. You will at the same time provide a worthy husband for your daughter, and procure everlasting repose to the soul of your poor husband." The widow could not for a moment resist this dreadful summons, which had not the most distant appearance of proceeding from Louis Brahant, whose countenance exhibited no visible change, and whose lips were close and motionless during the delivery of it. Accordingly, she consented immediately to receive him for her son-in-law. Louis's finances, however, were in a very low situation, and the formalities attending the marriage-contract rendered it necessary for him to exhibit some show of riches, and not to give the ghost the lie direct. He accordingly went to work on a fresh subject, one Cornu, an old and rich banker at Lyons, who had accumulated immense wealth by usury and extortion, and was known to be haunted by remorse of conscience on account of the manner in which he had acquired it. Having contracted an intimate acquaintance with this man, he one day, while they were sitting together in the usurer's little back parlour, artfully turned the conversation on religious subjects, on demons, and spectres, the pains of purgatory, and the torments of hell. During an interval of silence between them, a voice was heard, which, to the astonished banker, seemed to be that of his deceased father, complaining, as in the former case, of his dreadful situation in purgatory, and calling upon him to deliver him instantly from thence, by putting into the hands of Louis Brahant, then with him, a large sum for the redemption of Christians then in slavery with the Turks; threatening him at the same time with eternal damnation if he did not take this method to expiate, likewise, his own sins. Louis Brahant, of course, affected a due degree of astonishment on the occasion, and further promoted the deception by acknowledging his having devoted himself to the prosecution of the charitable designs imputed to him by the ghost. An old usurer is naturally suspicious. Accordingly, the wary banker made a second appointment with the ghost's *delegate* for the next day: and to render any design of imposing upon him utterly abortive, took him into the open fields, where not a house, or a tree, or even a bush, or a pit were in sight, capable of screening any supposed confederate. This extraordinary caution excited the ventriloquist to exert all the powers of his art. Wherever the banker conducted him, at every step his ears were saluted on all sides with the complaints and groans, not only of his father, but of all his deceased relations, imploring him for the love of God, and in the name of every saint in the calendar, to have mercy on his own soul and theirs, by effectually seconding with his purse the intentions of his worthy companion. Cornu could no longer resist the voice of Heaven, and accordingly carried his guest home with him, and paid him down ten thousand crowns; with which the honest ventriloquist returned to Paris, and married his mistress. The catastrophe was fatal. The secret was afterward blown, and reached the usurer's ears, who was so much affected by the loss of his money and the mortifying railleries of his neighbours, that he took to his bed and died.

Another trick of a similar kind was played off about sixty or seventy years ago on a whole community by another French ventriloquist. "M. St. Gill, the ventriloquist, and his intimate friend, returning home from a place whither his business had carried him, sought for shelter from an approaching thunder-storm in a neighbouring convent. Finding the whole community in mourning, he inquired the cause, and was told that one of the body had died lately, who was the ornament and delight of the whole society. To pass away the time, he walked into the church, attended by some of the religious, who showed him the tomb of their deceased brother, and spoke feelingly of the scanty honours they had bestowed on his memory. Suddenly a voice was heard, apparently proceeding from the roof of the choir, lamenting the situation of the defunct in purgatory, and reproaching the brotherhood with their lukewarmness and want of zeal on his account. The friars, as soon as their astonishment gave them power to speak, consulted together, and agreed to acquaint the rest of the community with this singular event, so interesting to the whole society. M. St. Gill, who wished to carry on the joke a little further, dissuaded them from taking this step, telling them that they would be treated by their absent brethren as a set of fools and visionaries. He recommended to them, however, the immediately calling the whole community into the church, where the ghost of their departed brother might probably reiterate his complaints. Accordingly, all the friars, novices, lay-brothers, and even the domestics of the convent, were immediately summoned and called together. In a short time the voice from the roof renewed its lamentations and reproaches, and the whole convent fell on their faces, and vowed a solemn reparation. As a first step, they chanted a *De profundis* in a full choir; during the intervals of which the ghost occasionally expressed the comfort he received from their pious exercises and ejaculations on his behalf. When all was over, the prior entered into a serious conversation with M. St. Gill; and on the strength of what had just passed, sagaciously inveighed against the absurd incredulity of our modern skeptics and pretended philosophers, on the article of ghosts or apparitions. M. St. Gill thought it high time to disabuse the good fathers. This purpose, however, he found it extremely difficult to effect, till he had prevailed upon them to return with him into the church, and there be witnesses of the manner in which he had conducted this ludicrous deception." Had not the ventriloquist, in this case, explained the cause of the deception, a whole body of men might have sworn, with a good conscience, that they had heard the ghost of a departed brother address them again and again in a supernatural voice.

It is highly probable that many of those persons termed witches and necromancers in ancient times, who pretended to be invested with supernatural powers, performed their deceptions by the art of ventriloquism. The term literally means, *speaking from the belly;* and, in accordance with this idea, we find that the Pythoness, or witch of Endor, to whom Saul applied for advice in his perplexity, is designated in the Septuagint translation of the Old Testament, "a woman that speaks from her belly or stomach," as most magicians affected to do; and some authors have informed us that there were women who had a demon which spake articulately from the lower part of their stomachs, in a very loud, though hoarse tone. Umbræ cum saganâ resonarent triste et acutum.—Hor. Sat., viii. lib. i.

Our English translation "familiar spirit," in Hebrew signifies "the spirit of *Ob* or *Oboth*." The word *Ob*, in its primitive sense, denotes a *bottle* or *vessel of leather* wherein liquors were put; and it is not unlikely that this name was given to witches, because in their fits of enthusiasm they swelled in their bellies like a bottle. The occasion of this swelling is said by some authors to proceed from a demon's entering into the sorceress *per partes genitales*, and so ascending to the bottom of her stomach, from whence, at that time, she uttered her predictions; and for this reason the Latins call such persons *Ventriloqui*, and the Greeks Εγγαστριμυθοι, that is, *people who speak out of their bellies*. Cælius Rhodiginus (Antiq. lib. 8, c. 10) says, in reference to such cases, "While I am writing concerning ventriloquous persons, there is in my own country a woman of a mean extract who has an unclean spirit in her belly, from whence may be heard a voice, not very strong indeed, but very articulate and intelligible. Multitudes of people have heard this voice, as well as myself, and all imaginable precaution has been used in examining into the truth of this fact:"—"Quando futuri avida portentus mens, sæpe accersitum, ventriloquam ac exutam amictu, ne quid fraudis occultaret, inspectare et audire concupivit." The author adds, "This demon is called *Cincinnatulus*, and when the woman calls upon him by his name, he immediately answers her." Several ancient writers have informed us, that in the times of paganism evil spirits had communion with these *ventriloquæ per partes secretiores*. Chrysostom says, "Traditur Pythia fœmina fuisse, quæ in Tripodes sedens expansa malignum spiritum per interna immissum, et per genitales partes subeuntem excipiens, furore repleretur, ipsaque resolutis crinibus baccharetur, ex ore spumam emittens, et sic furoris verba loquebatur," &c.

Spectres have also been produced by such optical exhibitions as the phantasmagoria. By means of this instrument, a spectre can be made apparently to start up from a white mist, and to rush forward towards the spectator with an horrific aspect. If a thin screen were placed in a dark room, and the lantern of the phantasmagoria, with its light properly concealed, the most terrific phantoms might be exhibited, which would confound and appal every one previously unacquainted with the contrivance, especially if the exhibition was suddenly made at the dead hour of night. By means of such exhibitions, combined with the art of ventriloquism and the assistance of a confederate, almost every thing that has been recorded respecting spectres and apparitions might be realized.

I shall conclude these illustrations of apparitions by presenting the reader with a description of the *ghost of a flea*, by Mr. Varley, formerly alluded to, as a specimen of the folly and superstition that still degrade the present age.

"With respect to the vision of the ghost of the flea, as seen by Mr. Blake, it agrees in countenance with one class of people under Gemini, which sign is the significator of the flea, whose brown colour is appropriate to the colour of the eyes in some full-toned Gemini persons, and the neatness, elasticity, and tenseness of the flea are significant of the elegant dancing and fencing sign Gemini. The spirit visited his imagination in such a figure as he never anticipated in an insect. As I was anxious to make the most correct investigation in my power of the truth of these visions, on hearing of this spiritual apparition of a flea, I asked him if he could draw for me the resemblance of what he saw. He instantly said, 'I see him now before me.' I therefore gave him paper and a pencil, with which he drew the portrait, of which a fac-simile is given in this number. I felt convinced by his mode of proceeding that he had a real image before him; for he left off and began on another part of the paper to make a separate drawing of the mouth of the flea, which the spirit having opened, he was prevented from proceeding with the first sketch till he had closed it. During the time occupied in completing the drawing, the flea told him that all fleas were inhabited by the souls of such men as were by nature bloodthirsty to excess, and were therefore providentially confined to the size and form of such insects; otherwise, were he himself, for instance, the size of a horse, he would depopulate a great part of the country. He added, that, 'if in attempting to leap from one island to another, he should fall into the sea, he could swim, and could not be lost.' This spirit afterward appeared to Blake, and afforded him a view of his whole figure, an engraving of which I shall give in this work."

N.B.—Blake, who died only two or three years ago, was an ingenious artist, who illustrated Blair's Grave and other works, and was so much of an *enthusiast*, that he imagined he could call up from the vasty deep any spirits or corporeal forms. Were it not a fact that a work entitled "Zodiacal Physiognomy," written by John Varley, and illustrated with engravings, was actually published in the year 1828, by Longman & Co., we should have deemed it almost impossible that amid the light of the present age, any man capable of writing a grammatical sentence would *seriously* give such a description as that quoted above, and attach his belief to such absurdity and nonsense. But amid all our boasted scientific improvements and discoveries, it appears that the clouds of ignorance and superstition still hang over a large body of our population, and that the light of the millennial era, if it have yet dawned, is still far from its meridian splendour.

After what has been now stated respecting the circumstances which may have led to the popular belief of spectres and apparitions, it would be almost needless to spend time in illustrating the futility of such a belief. There is one strong objection against the probability of apparitions, and that is, that they scarcely appear to be intelligent creatures, or, at least, that they possess so small a degree of intelligence that they are unqualified to act with prudence, or to use the means requisite to accomplish an end. Ghosts are said often to appear in order to discover some crime that had been committed; but they never appear to a magistrate or a person of authority and intelligence, but to some illiterate clown who happens to live near the place where the crime was committed—to some person who has no connexion at all with the affair, and who, in general, is the most improper person in the world for making the discovery. Glanville, who wrote in defence of witchcraft and apparitions, relates, for instance, the following story: "James Haddock, a farmer, was married to Elenor Welsh, by whom he had a son. After the death of Haddock, his wife married one Davis, and both agreed to defraud the son by the former marriage of a lease bequeathed to him by his father. Upon this the ghost of Haddock appeared to one Francis Taverner, the servant of Lord Chichester, and desired him to go to Elenor Welsh, and to inform her that it was the will of her former husband that their son should enjoy the lease. Taverner did not at first execute this commission, but he was continually haunted by the apparition in the most hideous shapes, which even threatened to tear him in pieces, till at last he delivered the message." Now, had this spectre possessed the least common sense, it would have appeared first to Elenor Welsh and her husband Davis, and frightened them into compliance at once, and not have kept poor Taverner, who had no concern in the matter, in such constant disquietude and alarm.

Another odd circumstance respecting apparitions is, that *they have no power to speak till they are addressed.* In Glanville's relations, we read of an old woman that appeared often to David Hunter, a neat-herd, at the house of the Bishop of Down. Whenever she appeared, he found himself obliged to follow her; and for three-quarters of a year, poor David spent the whole of almost every night in scampering up and down through the woods after this old woman. How long this extraordinary employment might have continued it is impossible to guess, had not David's violent fatigue made him one night exclaim, "Lord bless me!—would I were dead!—shall I never be delivered from this misery?" On which the phantom replied, "Lord bless me too!—It was happy you spoke first, for till then I had no power to speak, though I have followed you so long!" Then she gave him a message to her two sons, though David told her he remembered nothing about her. David, it seems, neglected to deliver the message, at which the old beldam was so much provoked that she returned and hit him a hearty blow on the shoulder, which made him cry out and then speak to her. Now, if she could not speak till David addressed her, why might she not have applied this oratorial medicine the first time she appeared to him? It would have saved both herself and him many a weary journey, and certainly David would much rather have had half a dozen blows from her choppy fists, than have wanted so many nights' sleep. To complete the story, it must be added, that when David's wife found it impossible to keep him from following the troublesome visiter, she trudged after him, but was never gratified with a sight of the enchantress.—See Ency. Brit., Art. *Spectre.*

What imaginable purpose can be served by such dumb spectres that cannot speak till they are addressed, or by sending apparitions from the invisible world that appear destitute of common sense? It is remarked by Glanville, that ghosts are generally very eager to be gone; and, indeed, they are frequently so much so, that, like children and thoughtless fools, they do not stay to tell their errand. It appears altogether inconsistent with any rational or scriptural ideas of the overruling providence of the Almighty, to suppose that such beings would be selected for administering the affairs of his kingdom, and for maintaining an intercourse between the visible and invisible worlds. It is also stated to be one peculiarity of spectres that *they appear only in the night.* But if they are sent to this sublunary region on affairs of importance, why should they be afraid of the light of the sun? In the light of day their message would be delivered with as much ease, and with more chance of success. As it would excite less fear, it would be listened to with more calmness and attention; and were they to exhibit themselves before a number of intelligent witnesses in the full blaze of day, the purposes for which they were sent would be more speedily and securely accomplished. The celestial messengers whose visits are recorded in Scripture, appeared most frequently during the light of day, and communicated their messages, in many instances, to a number of individuals at once —messages which were of the utmost importance to the individuals addressed, and even to mankind at large. To give credit, therefore, to the popular stories respecting ghosts and apparitions imbodies in it a reflection on the character of the All-wise Ruler of the world, and a libel on the administrations of his moral government.

No. VIII.—*Explosions of Steam-engines.* P. 68, 172.

As steam-engines are now applied to the purpose of impelling vessels along seas and rivers, as well as to many important manufacturing processes, and are capable of still more extensive applications, and of higher improvements than they have yet attained—it is of the utmost importance that every circumstance should be carefully guarded against which has the remotest tendency to endanger the bursting of the boiler,—and that no person be intrusted with the direction of such engines who is not distinguished for prudence and caution, or who is unacquainted with their construction and the principle of their operation. For, to ignorance and imprudence are to be ascribed many of those accidents which have happened from the bursting of the boilers of these engines. This remark is strikingly illustrated by the following and many other tragical occurrences:—

In the month of August, 1815, the following melancholy accident happened at Messrs. Nesham and Co's. colliery at Newbottle. The proprietors had formed a powerful locomotive steam-engine for the purpose of drawing ten or twelve coal wagons to the staith at one time; and on the day it was to be put in motion, a great number of persons belonging to the colliery collected to see it; but, unfortunately, just as it was going off, the boiler of the machine burst. The engine-man was dashed to pieces, and his mangled remains blown 114 yards. The top of the boiler, nine feet square, weighing nineteen hundred weight, was blown 100 yards, and the two cylinders 90 yards. A little boy was also thrown to a great distance. By this accident *fifty-seven persons* were killed and wounded, of whom eleven died on Sunday night; several remaining dangerously ill. The cause of the accident is accounted for as follows:—The engine-man said, "*As there are several owners and viewers here, I will make her* (the engine) *go in grand style;*" and he had scarcely got upon the boiler to loose the screw of the safety valve, when, being overheated, it exploded.—*Monthly Magazine*, vol. xl, p. 181.

From what is here stated, it appears that this tragical accident was occasioned by a combination of vanity, ignorance, and imprudence in the person to whom the direction of the engine was committed.—The following accident which happened to the *Washington steamboat*, belonging to *Wheeling*, N. America, is attributed to a somewhat similar cause.

"This boat started from Wheeling on Monday, June 10th, 1816, and arrived at Marietta on Tuesday evening at 7 o'clock, and came safely to anchor, where she remained till Wednesday morning. The fires had been kindled, and the boilers sufficiently hot, preparatory to her departure, when the anchor was weighed and the helm put to larboard, in order to wear her in a position to start her machinery; but only having one of her rudders shipped at the time, its influence was not sufficient to have the desired effect, and she immediately shot over under the Virginia shore, where it was found expedient to throw over the kedge at the stern to effect it. This being accomplished, the crew were then required to haul it on board, and were nearly all collected in the quarter for that purpose. At this unhappy fatal moment, the end of the cylinder towards the stern exploded, and threw the whole contents of hot water among them, and spread death and torture in every direction. The captain, mate, and several seamen were knocked overboard, but were saved, with the exception of one man, by boats from the town, and by swimming to the shore. The whole town was alarmed by the explosion, and all the physicians, with a number of citizens, went immediately to their relief. On going on board, a melancholy and truly horrible scene was presented to view. Six or eight persons were nearly skinned from head to foot, and others scalded, making in the whole seventeen. In stripping off their clothes the skin peeled off with them to a considerable depth. Added to this melancholy sight, the ears of the pitying spectators were pierced by the screams and groans of the agonizing sufferers, rendering the scene horrible beyond description.

"The cause of this melancholy catastrophe may be accounted for by the cylinder not having vent through the safety valve, which was firmly stopped by the weight which hung on the lever having been unfortunately slipped to its extreme, without its being noticed, and the length of time occupied in wearing before her machinery could be set in motion, whereby the force of the steam would have been expanded; these two causes united confined the steam till the strength of the cylinders could no longer contain it, and gave way with great violence. Six of the unfortunate sufferers died on Wednesday night, and one or two others are not expected to survive."—*Louisiana Gazette and New-Orleans Mercantile Advertiser*, July 8th, 1816.

Since the above accidents happened, many others of a similar nature have occurred which have ultimately been ascertained to have been owing either to *ignorance* or to carelessness and inattention, which are the natural results of ignorance. As steamboats are now navigating all our friths and rivers, and even ploughing the ocean itself; and as steam-carriages are likely soon to come into general use for the conveyance of passengers and goods, it is of the utmost importance to their success, and to the safety of the public, that every precaution be adopted to prevent those explosions and disarrangements of the machinery, which might be attended with fatal effects. But although science and art may accomplish all that seems requisite for the prevention of danger, unless persons of prudence and intelligence be obtained for the superintendence and direction of such machines, the efforts of their projectors to prevent accidents may prove abortive. And until the tone of intellect among the middling and lower orders be somewhat more elevated than it is at present, it may be difficult to obtain persons for this purpose of the requisite qualifications.

The following recent accidents from steamboat explosions in all probability originated from causes similar to those to which I have now alluded.

The boiler of the steamboat *Caledonia*, plying on the Mississippi, exploded on the 11th of April, 1830, killing and wounding about fifteen of the passengers and seven of the crew,—seven or eight of whom were blown overboard and lost. It was expected that some of the wounded would recover, although badly scalded. The boiler burst in the side while the boat was under way, and about two hours after being wooded. There were on board about four hundred deck and sixty cabin passengers, besides the crew, being altogether about five hundred souls. The hull of the boat was uninjured. It is said that the accident arose from the passengers crowding to one side of the boat, by which one side of the boiler was exposed to the direct action of the fire, and when the boat righted, a quantity of steam was suddenly generated greater than the safety valve could carry off.—The number of persons who have lost their lives by explosions in America, since the commencement of the season (1830), is not much short of one hundred,—sixty in the *Helen Macgregor*, four in the *Huntress*, nine in the *Justice Marshall*, and fourteen in the *Caledonia*, besides those of the latter who, it was feared, would not recover from the injuries they had sustained.

In these and other instances, it is more than probable that a want of attention to the *natural laws* of the universe, and to the obvious effects which an enlightened mind should foresee they would produce, was the chief cause of the destruction of so many human beings, and of the sufferings of those whose lives were preserved. The same remark may be applied to the circumstances connected with a late fatal accident which happened on the Liverpool and Manchester railroad.

On Friday afternoon, February 1, 1833, as the second-class train, which leaves Liverpool at three o'clock, was proceeding over Parr Moss, a little on the other side of Newton, one of the tubes which passes longitudinally through the boiler, burst. The consequence was, that a quantity of water fell into the fire, steam was generated in abundance, and the engine stopped. Several of the passengers alighted to see what was the matter, and they incautiously got upon the line of railway taken by the trains in going to Liverpool,—the contrary to that on which the disabled engine stood. While they were in this situation, a train of wagons from Bolton, proceeding to Liverpool, came up. The persons who had alighted did not see the advancing train, being enveloped in a dense cloud of vapour; and, from the same cause, they were by the conductor also unseen. They accordingly came upon them with fearful violence; several were knocked down, and the wheels of the train passed over four of them. Three of the unfortunate party were killed upon the spot—their bodies being dreadfully crushed; the fourth survived, and was taken forward to the infirmary, but his recovery was considered hopeless. Two of the three killed were elderly persons, whose names were unknown; the third, an interesting young man, who had formerly been in the employ of the company as a fireman, and who was married only three weeks before. The survivor was a boy, about sixteen years of age, who was proceeding from Belfast to Halifax, where his parents reside. The casualty which was the occasion of this serious result was itself but trifling, as the train went forward to Manchester after a short delay.

This shocking catastrophe was evidently caused by rashness and imprudence—by not foreseeing what might probably arise from a certain combination of circumstances; or in other words, by inattention to certain natural laws, both on the part of those who were connected with the Liverpool train of wagons and of those who conducted the Bolton train. In regard to the passengers in the Liverpool train, it was highly improper that they should have left their seats on the carriage. The accident which befell the unfortunate Mr. Huskisson, at the opening of the railway, should have operated as an impressive warning against such a practice. In the next place, it was most imprudent to venture upon the other line of railway, more especially when a cloud of steam prevented them from seeing what was passing around them. In regard to the person who had the command of the Bolton train, it was incautious and imprudent in the highest degree to urge his machinery forward, when he beheld a volume of smoke immediately before him; the least consideration must have convinced him that some accident must have happened, and that the cloud of steam would prevent those enveloped in it from perceiving the approach of his vehicle; and, therefore, he ought immediately to have abated his speed, so as to have acquired a complete command of the engine by the time it arrived at the spot where the steam was floating. Hence the importance, in conducting steam-engines and other departments of machinery, of having as superintendents men of prudence and of enlightened minds, capable of foreseeing the probable effects of every combination of circumstances that may happen to occur. For *ignorance* is generally proud, obstinate, incautious, precipitate in its movements, and regardless of consequences;

so that, through its heedlessness and folly, the most splendid inventions are often impeded in their progress, and their value and utility called in question.

The Liverpool and Manchester railway, and the locomotive powers of the machinery and engines which move along it, constitute one of the most splendid and useful improvements of modern times. From the last half-yearly report of the directors, from June 30 to December 31, 1832, it is satisfactorily proved that this railway is completely efficient and applicable to all the great objects for which it was designed. During the period now specified, there were carried along the railway 86,842 tons goods, 39,940 tons coals, and 182,823 passengers, which is 73,498 fewer than in the corresponding six months of 1831, owing to the prevalence of cholera in Dublin, and in the towns of Manchester and Liverpool. Were this railway continued to London, it is calculated that the journey from Liverpool to the metropolis, a distance of more than two hundred miles, might be performed in eight or ten hours.

No. IX.—*Circumstances which led to the invention of the Safety Lamp*. Pages 54, 183.

This lamp, by means of which hundreds of lives have been preserved, was invented in the autumn of 1815. Sir Humphry Davy, the inventor, was led to the consideration of this subject, by an application from Dr. Gray, now Bishop of Bristol, the chairman of a society established in 1813, at Bishop-Wearmouth, to consider and promote the means of preventing accidents by fire in coal-pits. Being then in Scotland, he visited the mines on his return southward, and was supplied with specimens of fire-damp, which, on reaching London, he proceeded to examine and analyze. He soon discovered that the carburetted hydrogen gas, called fire-damp by the miners, would not explode when mixed with less than six, or more than fourteen, times its volume of air; and further, that the explosive mixture could not be fired in tubes of small diameters and proportionate lengths. Gradually diminishing these, he arrived at the conclusion that a tissue of wire in which the meshes do not exceed a certain small diameter, which may be considered as the ultimate limit of a series of such tubes, is impervious to the inflamed air; and that a lamp covered with such tissue may be used with perfect safety, even in an explosive mixture which takes fire and burns within the cage, securely cut off from the power of doing harm. Thus, when the atmosphere is so impure that the flame of a lamp itself cannot be maintained, the Davy still supplies light to the miner, and turns his worst enemy into an obedient servant. This invention, the certain source of large profit, he presented with characteristic liberality to the public. The words are preserved in which, when pressed to secure to himself the benefit of a patent, he declined to do so, in conformity with the high-minded resolution which he formed, upon acquiring independent wealth, of never making his scientific eminence subservient to gain. "I have enough for all my views and purposes; more wealth might be troublesome, and distract my attention from those pursuits in which I delight. More wealth could not increase my fame or happiness. It might undoubtedly enable me to put four horses to my carriage; but what would it avail me to have it said that Sir Humphry drives his carriage and four?"—*Gallery of Portraits.*

No. X.—*On the Utility of the Remarks and Observations of Mechanics and Manufacturers.* Page 185.

That the remarks of experienced artists and labourers may frequently lead to useful discoveries may be illustrated by the following facts:—"A soap manufacturer remarked that the residuum of his ley, when exhausted of the alkali for which he employed it, produced a corrosion of his copper boiler for which he could not account. He put it into the hands of a scientific chymist for analysis, and the result was the discovery of one of the most singular and important chymical elements, *iodine.* The properties of this, being studied, were found to occur most appositely in illustration and support of a variety of new, curious, and instructive views then gaining ground in chymistry, and thus exercised a marked influence over the whole body of that science. Curiosity was excited; the origin of the new substance was traced to the sea-plants, from whose ashes the principal ingredient of soap is obtained, and ultimately to the sea-water itself. It was thence hunted through nature, discovered in salt-mines and springs, and pursued into all bodies which have a marine origin; among the rest, into sponge. A medical practitioner then called to mind a reputed remedy for the cure of one of the most grievous and unsightly disorders to which the human species is subject—the *goitre*—which infests the inhabitants of mountainous districts to an extent which, in this favoured land, we have happily no experience of, and which was said to have been originally cured by the ashes of burnt sponge. Led by this indication, he tried the effect of iodine on that complaint, and the result established the extraordinary fact that this singular substance, taken as a medicine, acts with the utmost promptitude and energy on goitre, dissipating the largest and most inveterate in a short time, and acting (of course with occasional failures, like all other medicines) as a specific or natural antagonist against that odious deformity. It is thus that any accession to our knowledge of nature is sure, sooner or later, to make itself felt in some practical application, and that a benefit conferred on science, by the casual observation or shrewd remark of even an unscientific or illiterate person, infallibly repays itself with interest, though often in a way that could never have been at first contemplated."*

Iodine was *accidentally* discovered (as above stated) in 1812, by M. de Courtois, a manufacturer of saltpetre at Paris, and derived its first illustrations from M. Clement and M. Desormes. Its name literally signifies a *violet colour*. Its specific gravity is about 4. It becomes a violet-coloured *gas* at a temperature below that of boiling water; it combines with the metals, with phosphorus and sulphur, with the alkalis and metallic oxides, and forms a detonating compound with ammonia. Dr. Coindet of Geneva first recommended the use of it, in the form of tincture, for the cure of goitres. Some readers may perhaps require to be informed that the goitre is a large fleshy excrescence that grows from the throat, and sometimes increases to an enormous size. The inhabitants of certain parts of Switzerland, especially those in the republic of *Valais*, are particularly subject to this shocking deformity.

No. XI.—*Liberality of Religious Sectaries in America, contrasted with British bigotry.* Page 353.

The following sketches are taken from Stuart's "*Three Years in North America.*" When at Avon, a village in the north-west part of the state of New-York, Mr. Stuart went to attend a church about a mile distant, of which he gives the following description: "The horses and carriages were tied up in great sheds near the church-doors, during the time of service. The day was hot, and the precentor, as usual, in the centre of the front gallery, opposite to the minister, officiated, not only without a gown, but without a coat upon his back. There was some sort of instrumental music—hautboys and bassoons, I think, against which there are no prejudices in this country. The clergyman, a very unaffected, sincere-looking person, delivered a plain sensible discourse, in which he introduced the names of Dr. Erskine and Dr. Chalmers, which sounded strange to us, considering where we were, on the western side of the Atlantic, not very far from the falls of Niagara. At the close of his sermon, he addressed his hearers in some such terms as these:—'My friends, the sacrament of the Lord's Supper is to be dispensed here this evening. This is a free church, open to all—Presbyterians, Methodists, Baptists, and all other denominations of Christians. his is according to our belief. All are invited; the risk is theirs.' Such liberality is, we find on inquiry, not unusual among the clergymen and congregations of different sects, with the exception in general of Unitarians. I observe an example recorded in Hosack's *Life of Clinton;* and as it relates to the great father of the United States, and is of unquestionable authority, I think it of sufficient interest for insertion. 'While the American army, under the command of Washington, lay encamped in the vicinity of Morristown, New-Jersey, it occurred that the service of the communion (then observed semi-annually only) was to be administered to the Presbyterian church in that village. In a morning of the previous week, the general, after his accustomed inspection of the camp, visited the house of the Rev. Dr. Jones, then pastor of that church, and, after the usual preliminaries, thus accosted him—' Doctor, I understand that the Lord's Supper is to be celebrated with you next Sunday. I would learn, if it accords with the canons of your church to admit communicants of another denomination?' The doctor rejoined, 'Most certainly. Ours is not the Presbyterian table, general, but the Lord's table, and we hence give the Lord's invitation to all his followers, of whatever name.' The general replied, 'I am glad of it; that is as it ought to be—but as I was not quite sure of the fact, I thought I would ascertain it from yourself, as I propose to join with you on that occasion. Though a member of the Church of England, I have no exclusive partialities.' The doctor reassured him of a cordial welcome, and the general was found seated with the communicants the next Sabbath.

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* Herschel's Prelim. Discourse to Nat. Phil.

"During my residence in the United States, subsequent to this period, I was frequently witness to the good understanding which generally prevails among clergymen professing different opinions on church forms and doctrinal points in this country; and I occasionally observed notices in the newspapers to the same purport. The two following I have preserved: 'The corner-stone of a new Baptist church was laid at Savannah, in Georgia, and the ceremonial services were performed by clergymen of the Methodist, German, Lutheran, Presbyterian, Episcopal, and Baptist churches.'—'The sacrament of the Lord's Supper was administered in the Rev. Mr. Post's church (Presbyterian church at Washington), and, *as usual*, all members of other churches in regular standing were invited to unite with the members of that church in testifying their faith in, and love to, their Lord and Saviour. The invited guests assembled around the table; and it so happened that Mr. Grundy, a senator from Tennessee, and two Cherokee Indians, were seated side by side.' Nothing is more astounding in the stage-coach intercourse with the people of this country, as well as in the barrooms where travellers meet, than the freedom and apparent sincerity of their remarks, and the perfect feeling of equality with which the conversation is maintained, especially on religious matters. I have heard the most opposite creeds maintained, without any thing like acrimonious discussion or sarcastic remark, by persons in the same stage, professing themselves undisguisedly Calvinists, Episcopalians, Methodists, and Unitarians," &c.

If such are the liberal views entertained in America on religious subjects, and if such dispositions are more congenial to the spirit of the Christian system, than the fiery and unhallowed zeal and unholy jealousies which many religionists display—why are they not more frequently manifested in our own country? for the difference of localities and customs cannot alter the nature and obligation of moral principles and actions. What a striking contrast to the scenes now exhibited are such facts as the following: "The Rev. J. T. Campbell, Rector of Tilston, in the diocess of Chester, *has been suspended from his clerical function* for twelve months, with a sequestration of his benefice for that time, *for preaching in a Methodist meeting-house* in Nantwich, and in other similar places within the diocess."—"The Rev. Dr. Rice, curate of St. Luke's, London, made himself conspicuous the other day at Mr. Wakely's dinner, has, in consequence of the liberal sentiments he then expressed on the subject of church reform, fallen under the censure of his diocesan." Both these notices appeared in most of the newspapers in January, 1833, and were never contradicted! If such conduct in the rulers of the church were *warranted* by the doctrines or precepts of the New Testament, Christianity would be unworthy of any man's attention or support. If the principles and persecuting spirit involved in such decisions were countenanced and supported by the laws of the state, we should soon be subjected to all the burnings, hangings, maimings, tortures, and horrid cruelties which distinguished the dark ages of popery and the proceedings of the Star Chamber. How long will it be ere professed Christians display *a Christian spirit?* and what is the utility of Christianity to the world, unless candour, forbearance, *love*, meekness, and other Christian virtues be the characteristics of its professed votaries? We dare any person to bring forward a single instance of a man's being converted to the faith of our holy religion by the display of unhallowed zeal, furious bigotry, sectarian contentions, or the manifestation of a domineering and persecuting spirit. But thousands of instances could be produced of such dispositions being the means of recruiting the ranks of infidelity and licentiousness. The following statement, sent to the editor of the *Liverpool Mercury*, Feb. 14, 1833, displays the *liberality* of certain British clergymen in the thirty-third year of the nineteenth century. "I have been recently called on by death to part with one of my children. I waited upon the Rev. ——, of —— church (where I buried a child a short time ago), to arrange with him about its interment near the other. 'But to what place of worship do you go?' inquired most seriously the reverend divine. 'The Methodists, sir, of the New Connexion,' I replied. 'As you do not attend my church, I cannot, therefore, bury your child.—Where was your child baptized?' was his second inquiry. 'At the church of which I am a member,' I answered. 'How can you think,' exclaimed the *liberal* and pious, but indignant, minister, 'that I shall bury your child, which has been baptized by a dissenter? Take your child to be buried where it was baptized.'—'But, sir, we have no burial-ground connected with our chapel.' 'No matter; the churchwardens of my church have determined not to bury any that do not belong to the church. Go,' said the minister, 'to ——, and arrange with him.' So saying, he turned his back and left me.—R. EMERY."

The Duke of Newcastle—so notorious *for doing what he pleases with his own*—has the following clause introduced into certain leases in the neighbourhood of Nottingham: "*That in none of the houses to be built shall be held prayer-meetings, or any conventicles for the diffusion of sentiments contrary to the doctrines of the Church of England.*" A fine specimen, truly, of Christian liberality in the nineteenth century! If his grace the Duke of Newcastle attended to his prayers as *frequently* and *fervently* as the liturgy enjoins, he would be disposed to display a little more candour in reference to the "prayer-meetings" of his dissenting brethren. With regard to the leading *doctrines* of the Church of England, there are few dissenters disposed to find much fault with them. But what will his grace say of the indolence and avaricious conduct of many of the ministers of that church, which have been the cause of the rapid increase of dissenters? The vicar of Pevensey in Sussex (as appears from a petition of the parishioners, dated February 1, 1833) derives an income from the parish of about 1200*l*. a year, and yet has never once performed Divine service since his induction, *about seventeen years ago*. He has another living at Guestling, about fifteen miles distant, from which he derives a revenue of 400*l*. per annum. Whether he does duty there is not known; but it is not absurd to suppose that a parson who will not so much as *read prayers* for 1200*l*. is not very likely to preach for 400*l*.—R. Hodgson, dean of Carlisle, is also vicar of Burg-on-Sands, rector of St. George's in Hanover-square, vicar of Hellington; and yet at none of these places is he found officiating. The tithes received by the dean and chapter for Heshet amount to 1000*l*. or 1500*l*. a year; they pay the curate that does the duty 18*l*. 5*s*., or at the rate of one shilling a day—the wages of a bricklayer's labourer. In Wetheral and Warwick, the dean and chapter draw about 1000*l*. a year for tithes and 1000*l*. a year from the church lands, and they pay the working minister the sum of 50*l*. a year. The tithes of the parish of St. Cuthberts and St. Mary amount to about 1500*l*. a year, and the two curates who do the duty receive each the sum of 2*l.* 13*s.* 4*d.* a year!! Three brothers of the name of *Goodenough* monopolize *thirteen* pieces of church preferment. One of them is prebend of Carlisle, Westminster, and York—vicar of Wath All-Saints on Dearn, chaplain of Adwick, and chaplain of Brampton Bierlow. Those preferments produce, of course, several thousands, for which the incumbents perform absolutely nothing. And yet, one of the persons above alluded to had lately the effrontery to come to Carlisle and preach up "the church is in danger," because these shocking enormities are now exposed to public reprobation. See *Times* newspaper for March 7, 8, 1833. It would be no great breach of charity to suppose that it is such doctrines and *practices* as those now stated, that the Duke of Newcastle is determined to support with such a degree of persecuting zeal—and that pure Christianity, detached from its connexions with the state, is the object of his hatred and contempt.

No. XII.—*On the Demoralizing Effects of Infidel Philosophy.* Page 363–368.

With the view of corroborating and illustrating more fully the statements made in the pages referred to, the following facts may be stated in relation to the moral character of the inhabitants of France, particularly those of Paris.

In the first place, the vice of *gambling* prevails in the capital of France to an extent unknown in almost any other country. The *Palais Royale* is the grand focus of this species of iniquity, which is the fertile source of licentiousness, and of almost every crime. Mr. J. Scott, who visited Paris in 1814, thus describes this sink of moral pollution: "The Palais Royale presents the most characteristic feature of Paris; it is dissolute, gay, wretched, elegant, paltry, busy, and idle; it suggests recollections of atrocity, and supplies sights of fascination; it displays virtue and vice living on easy terms, and in immediate neighbourhood of each other. Excitements, indulgences, and privations—art and vulgarity—science and ignorance—artful conspiracies and careless debaucheries—all mingle here, forming an atmosphere of various exhalations, a whirl of the most lively images—a stimulating *melange* of what is most heating, intoxicating, and subduing." Sir W. Scott, who visited Paris in 1815, gives the following description of this infamous establishment: "The Palais Royale, in whose saloons and porticoes vice has established a public and open school for gambling and licentiousness, should be levelled to the ground, with all its accursed brothels and gambling houses—rendezvouses the more seductive to youth as being free from some of those dangers which would alarm timidity in places of avowedly scandalous resort. In the *Salon des Etrangers*, the most celebrated haunt of this Dom-Daniel, which I had the curiosity to visit, the scene was decent and silent to a degree of solemnity. An immense hall was filled with gamesters and spectators. Those who kept the bank and managed the affairs of the establishment were distinguished by the green shades which they wore to preserve their eyes—by their silent and grave demeanour, and by the paleness of their countenances, exhausted by their constant vigils. There was no distinction of persons, nor any passport required for entrance, save that of a decent exterior; and on the long tables, which were covered with gold, an artisan was at liberty to hazard his week's wages, or a noble his whole estate. Youth and age were equally welcome, and any one who chose to play within the limits of a trifling sum had only to accuse his own weakness if he was drawn into deeper or more dangerous hazard. Every thing appeared to be conducted with perfect fairness. The only advantage possessed by the bank (which is, however, enormous) is the extent of the funds, by which it is enabled to sustain any reverse of fortune; whereas, most of the individuals who play against the bank are in circumstances to be ruined by the first succession of ill luck; so that ultimately the small ventures merge in the stock of the principal adventurers, as rivers run into the sea. The profits of the establishment must indeed be very large, to support its expenses. Besides a variety of attendants, who distribute refreshments to the players gratis, there is an elegant entertainment, with expensive wines, regularly prepared about three o'clock in the morning for those who choose to partake of it. With such temptations around him, and where the hazarding an insignificant sum seems at first venial or innocent, it is no wonder that thousands feel themselves gradually involved in the vortex, whose verge is so little distinguishable, until they are swallowed up, with their time, talents, fortune, and frequently also both body and soul.

"This is vice with her *fairest vizard;* but the same unhallowed precinct contains many a secret cell *for the most hideous and unheard-of debaucheries;* many an open rendezvous of infamy, and many a den of usury and treason; the whole mixed with a vanity fair of shops for jewels, trinkets, and baubles; that bashfulness may not need a decent pretext for adventuring into the haunts of infamy. It was here that the preachers of revolution found, amid gamblers, desperadoes, and prostitutes, ready auditors of their doctrines, and active hands to labour in their vineyard. It was here that the plots of the Bonapartists were adjusted; and from hence the seduced soldiers, inflamed with many a bumper to the health of the exile of Elba, under the mystic names of *Jean de l'Epee* and Corporal Violet, were dismissed to spread the news of his approaching return. In short, from this central pit of Acheron, in which are openly assembled and mingled those characters and occupations which, *in all other capitals*, are driven to shroud themselves in separate and retired recesses—from this focus of vice and treason have flowed forth those waters of bitterness of which France has drunk so deeply."

The *state of marriage* in this country since the revolution is likewise the fertile source of immorality and crime. Marriage is little else than a state of legal concubinage, a mere temporary connexion, from which the parties can loose themselves when they please; and women are a species of mercantile commodity. Illicit connexions and illegitimate children, especially in Paris, are numerous beyond what is known in any other country. The following statement of the affairs of the French capital for the year ending 22d September, 1803, given by the prefect of police to the grand judge, presents a most revolting idea of the state of public morals:—During this year 490 men and 167 women committed suicide; 81 men and 69 women were murdered, of whom 55 men and 52 women were foreigners; 644 divorces; 155 murderers executed; 1210 persons condemned to the galleys, &c.; 1626 persons to hard labour, and 64 marked with hot irons; 12,076 public women were registered; large sums were levied from these wretched creatures, who were made to pay from 5 to 10 guineas each monthly, according to their rank, beauty, or fashion; 1552 kept mistresses were noted down by the police, and 380 brothels licensed by the prefect. Among the criminals executed were 7 fathers for poisoning their children, 10 husbands for murdering their wives, 6 wives that had murdered their husbands, and 15 children who had poisoned or otherwise destroyed their parents.

The glaring *profanation of the Sabbath* is another striking characteristic of the people of France, especially as displayed in the capital. Entering Paris on the Sabbath, a Briton is shocked at beholding all that reverence and solemnity with which that sacred day is generally kept in Christian countries, not only set aside, but ridiculed and contemned, and a whole people apparently lost to every impression of religion. The shops are all alive, the gaming-houses filled, the theatres crowded, the streets deafened with ballad-singers and mountebanks; persons of all ages, from the hoary grandsire to the child of four or five years, engaged in balls, routs, and dances—the house of God alone deserted, and the voice of religion alone unheard and despised. The Sabbath was the day appointed for celebrating the return of Bonaparte from Elba in 1815. In the grand square there were stationed two theatres of dancers and rope-dancers—two theatres of amusing physical experiments—six bands for dancing—a theatre of singers—a display of fireworks—a circus where Francone's troops were to exhibit—and, above all, that most delectable sport called *Matts de Cocagne.* The Matts de Cocagne consists of two long poles, near the tops of which are suspended various articles of cookery, such as roast beef, fowls, ducks, &c. The poles are soaped and rendered slippery at the bottom; and the sport consists in the ludicrous failures of those who climb to reach the eatables. Two Matts de Cocagne were also erected in the square Marjury; as also four bands for dancing, a theatre of rope-dancers, a theatre of amusing experiments, a theatre of singers, &c., and fireworks. These amusements were to commence at two o'clock P. M., and to last till night. Along the avenue of the *Champ de Elysees* there were erected 36 fountains of wine, 12 tables for the distribution of eatables, such as pies, fowls, sausages, &c. The distribution of the wine and eatables took place at three o'clock. At nine o'clock there was a grand firework at the Place de Concorde. Immediately afterward a detonating balloon ascended from the Champ de Elysees. The detonation took place when the balloon was at the height of 500 toises, or above 3000 feet. In the evening all the theatres were opened gratis, and all the public edifices were illuminated. Such was the mode in which the Parisians worshipped the "Goddess of Reason" on the day appointed for the Christian Sabbath.

That such profanation of the Sabbath is still continued, and that it is not confined to the city of Paris, but abounds in most of the provincial towns of France, appears from the following extract of a letter inserted in the Evangelical Magazine for January, 1833, from a gentleman who recently resided in different parts of that country:—"Could every pious reader of this letter be awakened, on the morning of that sacred day, as I have been, by the clang of the anvil, and, on his entrance into the streets and markets, observe business prosecuted or suspended according to the tastes of the tradesmen—could he mark the workmen on seasons of religious festival erecting the triumphal arch on the Sabbath morning, and removing it on the Sabbath evening, and notice the labourers, at their option, toiling all day at the public works—could he see the card-party in the hotel, and the nine-pins before every public house, and the promenaders swarming in all the suburbs—could he be compelled to witness on one Sunday a grand review of a garrison, and on another be disturbed by the music of a company of strolling players—and could he find, amid all this profanation, as I have found, no temple to which to retreat, save the barren cliff or the ocean-cave—surely he would feel and proclaim the truth, 'This people is destroyed for lack of knowledge.'" The same gentleman shows that this profanation is chiefly occasioned by "the destitution of Scriptural information which exists in France," which the following facts, among many others that came under his own observation, tend to illustrate. "On the road to M——, on a market-day, I stopped about a dozen persons, some poor, others of the better classes, and showing them the New Testament, begged them to inform me if they possessed it. With a *single* exception, they all replied in the negative. In the town of M—— I entered, with the same inquiry, many of the most respectable shops. Only *one* individual among their occupiers was the owner of a New Testament. One gentleman, who, during a week, dined with me at my inn, and who avowed himself a deist and a materialist, said that he had not seen a Testament for many years. Indeed, I doubted whether he had *ever* read it; for, on my presenting one to him, he asked if it contained an account of the *creation*. A journeyman bookbinder, having expressed a wish to obtain this precious book, remarked, on receiving it, in perfect ignorance of its *Divine* authority, that he dared to say it was 'a very fine work.' A student in a university, about 20 years of age, told me, that although he had seen the Vulgate (Latin) version of the New Testament, he had never met with it in a French translation. A young woman, who professed to have a Bible, produced instead of it a Catholic abridgment of the Scriptures, garbled in many important portions, and interlarded with the comments of the fathers."

Such facts afford a striking evidence of the hostility of the Roman Catholic clergy in France to the circulation of the Scriptures, and the enlightening of the minds of the community in the knowledge of Divine truths; and therefore it is no wonder that infidelity, materialism, and immorality should very generally prevail. "Even among the Protestants," says the same writer, "a large number of *their* ministers are worldly men, frequenting, as a pious lady assured me, 'the chase, the dance, and the billiard-table.' As to the public worship of God, the case is equally deplorable. In two large towns, and a population of 25,000, I found no Protestant sanctuary. In a third town, containing about 7000 inhabitants, there was an English Episcopal chapel for the British residents, but no French Protestant service. At a fourth, in which there was a Protestant church, the minister, who supplied four other places, preached *one* Sabbath in *five* weeks."

The mania for *dancing*, which pervades all classes and all ages, is another characteristic of the people of Paris, of which some idea may be formed from the following extract from a French public journal, dated August 2, 1804:—"The *dansomania* of both sexes seems rather to increase than decrease with the *warm* weather. *Sixty balls* were advertised for *last Sunday*; and for to-morrow *sixty-nine* are announced. Any person walking in the Elysian fields, or on the Boulevards, may be convinced that these temples of pleasure are not without worshippers. *Besides* these, in our own walks last Sunday, we counted no less than *twenty-two gardens* not advertised, where there was *fiddling and dancing*. Indeed, this pleasure is tempting, because it is very cheap. For a bottle of beer, which costs 6 sous (3*d.*), and 2 sous (1d.) to the fiddler, *a husband and wife, with their children, may amuse themselves from three o'clock in the afternoon till eleven o'clock at night*. As this exercise both diverts the mind and strengthens the body, and as Sunday is the only day of the week which the most numerous classes of people can dispose of, *without injury* to themselves or the state, *government encourages, as much as possible*, these *innocent amusements on that day*. In the garden of Chaumievre, on the Boulevard Neuf, we observed, in the same quadrilles, last Sunday, *four generations*, the great-grandsire dancing with his great-great-granddaughter, and the great-grandmamma dancing with her great-great-grandson. It was a satisfaction impossible to be expressed, to see persons of so many different ages all enjoying the same pleasure for the present, not remembering past misfortunes, nor apprehending future ones. The *grave* seemed equally distant from the girl of ten years old, and from her great-grandmamma of seventy years, and from the boy that had not seen three lustres, as from the great-grandsire reaching nearly fourscore years. In another quadrille were four lovers dancing with their mistresses. There, again, nothing was observed but an emulation who should enjoy the present moment. Not an idea of the past, or of time to come, clouded their thoughts; in a few words, they were perfectly happy. Let those tormented by avarice or ambition frequent those places on a Sunday, and they will be cured of their vile passions, if they are not incurable."*

Such are a few sketches of the moral state and character of the people of Paris, which, there is every reason to believe, are, with a few modifications, applicable to the inhabitants of most of the other large towns in France. Among the great mass of the population of that country, there appears to be no distinct recognition of the moral attributes of the Deity, of the obligation of the Divine law, or of a future and eternal state of existence. Whirled about incessantly in the vortex of vanity and dissipation, the Creator is lost sight of, moral responsibility disregarded, and present sensual gratifications pursued with the utmost eagerness, regardless whether death shall prove the precursor to permanent happiness or misery, or to a state of "*eternal sleep.*" Never, perhaps, even in a pagan country, was the Epicurean philosophy so systematically reduced to practice as in the country of Voltaire, Buffon, Mirabeau, Condorcet, Helvetius, and Diderot. It cannot be difficult to trace the present demoralization of France to the skeptical and atheistical principles disseminated by such writers, which were adopted in all their extent, and acted upon by the leaders of the first Revolution. Soon after that event, education was altogether proscribed. During the space of five years, from 1791 to 1796, the public instruction of the young was totally set aside, and, of course, they were left to remain entirely ignorant of the facts and doctrines of religion, and of the duties they owe to God and to man. It is easy, therefore, to conceive what must be the intellectual, the moral, and religious condition of those who were born a little before this period, and who now form a considerable portion of the population arrived at the years of manhood. A gentleman at Paris happened to possess a domestic of sense and general intelligence above his station. His master, upon some occasion, used to him the expression, "It is doing as we would be done by,—the Christian maxim." The young man looked rather surprised: "Yes," replied the gentleman, "I say, it is the doctrine of the Christian religion, which teaches us not only to do as we would be done by, but also to return good for evil."—"It may be so, sir," replied he, "but I had the misfortune to be born during the heat of the revolution, when it would have been death to have spoken on the subject of religion; and so soon as I was fifteen years old, I was put into the hands of the drill-sergeant, whose first lesson to me was, that, as a French soldier, I was to *fear neither God nor devil.*" It is to be hoped, that the rising generation in France is now somewhat improved in intelligence and morality beyond that which sprang up during the demoralizing scenes of the first revolution; but, in spite of all the counteracting efforts that can now be used, another generation, at least, must pass away, before the immoral effects produced by infidel philosophy, and the principles which prevailed during the "reign of terror," can be nearly obliterated.

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* Several of the above sketches are extracted from the "Glasgow Geography," a work which contains an immense mass of historical, geographical, and miscellaneous information.

I shall conclude these sketches with the following account of the *consecration* of the "Goddess of Reason," one of the most profane and presumptuous mockeries of every thing that is rational or sacred to be found in the history of mankind.

"The section of the Sans Cullotes declared at the bar of the Convention, November, 10, 1793, that they would no longer have priests among them, and that they required the total suppression of all salaries paid to the ministers of religious worship. The petition was followed by a numerous procession, which filed off in the hall, accompanied by national music. Surrounded by them, appeared a young woman* of the finest figure, arrayed in the robes of liberty, and seated in a chair, ornamented with leaves and festoons. She was placed opposite the president; and Chaumette, one of the members, said, '*Fanaticism* has abandoned the place of truth; squint-eyed, it could not bear the brilliant light. The people of Paris have taken possession of the temple, which they have regenerated; the Gothic arches which till this day resounded with *lies* now echo with the accents of truth; you see we have not taken for our festivals inanimate idols, it is a *chef d'œuvre* of nature whom we have arrayed in the habit of liberty; its sacred form has *inflamed* all hearts. The public has but one cry, 'No more altars, no more priests, no other God but the God of nature.' We, their magistrates, we accompany them from the temple of truth to the temple of the laws, to celebrate a new liberty, and to request that the *ci-devant church of Notre Dame be changed into a temple consecrated to reason and truth*.' This proposal, being converted into a motion, was immediately decreed; and the Convention afterward decided that the citizens of Paris, on this day, continued to deserve well of their country. The goddess then seated herself by the side of the president, who gave her a *fraternal kiss*. The secretaries presented themselves to share the same favour; *every one was eager to kiss the new divinity*, whom so many salutations *did not in the least disconcert*. During the ceremony, the orphans of the country, pupils of Bourdon (one of the members), *sang a hymn to reason*, composed by citizen Moline. The national music played Gosset's hymn to liberty. The Convention then mixed with the people, *to celebrate the feast of reason in her new temple*. A grand festival was accordingly held in the church of Notre Dame, in honour of this deity. In the middle of the church was erected a mount, and on it a very plain temple, the facade of which bore the following inscription—'*A la Philosophie*.' The busts of the most celebrated philosophers were placed before the gate of this temple. The torch of truth was in the summit of the mount, upon the altar of Reason, spreading light. The Convention and all the constituted authorities assisted at the ceremony. Two rows of young girls, dressed in white, each wearing a crown of oak leaves, crossed before the altar of reason, at the sound of republican music: each of the girls inclined before the torch, and ascended the summit of the mount. Liberty then came out of the temple of philosophy, towards a throne made of turf, to receive the homage of the republicans of both sexes, who sang a hymn in her praise, extending their arms at the same time towards her. Liberty ascended afterward, to return to the temple, and, in re-entering it, she turned about, casting a look of benevolence upon her friends; when she got in, every one expressed with enthusiasm the sensations which the goddess excited in them by songs of joy; and they swore never, never to cease to be faithful to her."

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* Madame Desmoulines, who was afterward *guillotined.*

Such were the festivities and ceremonies which were prescribed for the installation of this new divinity, and such the shameless folly and daring impiety with which they were accompanied! Such is the *Religion* of what has been presumptuously called *Philosophy*, when it has shaken off its allegiance to the Christian Revelation—a religion as inconsistent with the dictates of reason and the common sense of mankind as it is with the religion of the Bible. Never, in any age, was philosophy so shamefully degraded, and exposed to the contempt of every rational mind, as when it thus stooped to such absurd foolery and Heaven-daring profanity. Besides the impiety of the whole of this procedure,—which is almost without a parallel in the annals of the world,—there was an imbecility and a *silliness* in it altogether incompatible with those sublime ideas of creation and Providence which true philosophy, when properly directed, has a tendency to inspire. And how *inconsistently*, as well as inhumanely, did these worshippers of "liberty," "reason," and "truth" conduct themselves to the representative of their goddess, when, soon after, they doomed the lady, whom they had kissed and adored in the "temple of truth," to expire under the stroke of the guillotine! Such occurrences appear evidently intended by the moral Governor of the world to admonish us of the danger of separating science from its connexions with revealed religion, and to show us to what dreadful lengths, in impiety and crime, even men of talent will proceed, when the truths of Revelation are set aside, and the principles and moral laws of Christianity are trampled under foot.

THE END.

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"Well calculated to claim the attention of the interesting part of the community to which it is addressed."—*N. Y. Advocate.*

SUNDAY EVENINGS; OR, AN EASY INTRODUCTION TO THE READING OF THE BIBLE. [Nos. IV. and XIV. of the Boy's and Girl's Library.]

The title of this excellent little work sufficiently explains its object. As an introduction to the knowledge of Scripture History, and an incentive to the study of the Sacred Volume, it is calculated to produce the most happy effects upon the minds of children; and the simplicity o the language preserves to the story all those charms which are inherent in the narrative, but are sometimes lost to very youthful readers by their want of a perfect understanding of the words they read. Besides a developed and connected view, in easy language, of the Scripture story itself, the author has endeavoured to intersperse in the narrative such notices of the countries spoken of, together with such references to the New Testament and practical remarks, as would tend to make the book either more interesting, more intellectually improving, or more valuable in a moral and religious light: and it cannot fail of obtaining the approbation of all judicious and pious parents, and of proving, by the blessing of God, an assistance to the Christian mother, in giving to her children an early knowledge and love of his Sacred Word.

"The style is simple, the sentiments expressed Scriptural, and the book every way calculated as an assistant in the instruction of children.—*The Presbyterian.*

"To be commended cordially."—*The Churchman.*

"We recommend it particularly to mothers and guardians of the young, confident that it will obtain their approbation, and prove an assistance to them in giving those under their care an early knowledge and love of the Sacred Word."—*Am. Traveller*

"The work is well worthy the attention of parents and instructers, to whom we most cheerfully recommend it."—*Boston Mirror.*

"It will be found, we think, a useful auxiliary in the hands of parents, and a most winning book to children."—*Connecticut Journal.*

THE SON OF A GENIUS. BY MRS. HOFLAND.

[No. V. of the Boy's and Girl's Library.]

This admirable story has been too long familiar to the public—at least to that portion of it which has advanced beyond the period of childhood—to require either eulogy or description. It has for many years maintained its place among the best and most esteemed juvenile works in the English language; and its popularity is easily accounted for by the touching interest of the incidents, and the purity of the principles it inculcates both of wisdom and religion. The publishers were induced to reprint it as one of the numbers of the Boy's and Girl's Library, partly by the advice and solicitations of many of their friends, and their own knowledge of its merits, and partly by the consideration that it has long been out of print, and that it was very difficult to procure a copy.

"'The Son of a Genius' will afford a profitable study to parents, as well as an exquisite treat to youths. It is an admirable tale: fascinating in its delineations, admirable in its moral, just as a picture of the mind, a faithful and true portraiture of the results of genius vaccilating, unapplied, and turning to ruin, and the same genius supported by sound moral principle, strengthened by judicious exercise and continuous effort, useful and triumphant. It is a striking illustration of the importance of method, perseverance, and industry to produce the perfect fruits of genius; and the utter uselessness of delicate taste, vivid conception, rapid performance, aided by generous affections and engaging manner, to the attainment of excellence, without that *steady application*, which nothing but just moral principle can ensure. The story is not, however, a refined, metaphysical disquisition on genius; but a simple, engaging tale, which lets in upon the reader a sort experience worth a hundred essays."—*Connecticut Journal.*

"To youth of both sexes this work forms an excellent piece of reading."—*The Pennsylvanian.*

"To our young friends it will afford much entertainment."—*Boston Mirror.*

NATURAL HISTORY; OR UNCLE PHILIP'S CONVERSATIONS WITH THE CHILDREN ABOUT TOOLS AND TRADES AMONG THE INFERIOR ANIMALS. [No VI. of the Boy's and Girl's Library.]

The wonders of God's providence, as they are manifested in the figures, habits, and performances of the various creatures which fill the earth, the air, and the waters,—the endless varieties of form, the accuracy and ingenuity of their contrivances, whether for security or sustenance, and the admirable adaptation of their instruments to the works their instinct prompts them to construct, supply an exhaustless theme for observation and astonishment, and call forth in the mind the most exalted ideas of the Supreme wisdom and beneficence. In the captivating volume which forms the sixth number of the Boy's and Girl's Library, a portion of this department of science is treated of with consummate ability, and the work has deservedly received the highest encomiums, not only for the extent, utility, and interesting nature of the information it conveys, but also for the skill with which the ideas and language are adapted to the tastes as well as the capacities of youthful readers. But these are not its only or its greatest merits: its highest claims to praise are the tone of sincere and earnest piety which pervades the conversations, and the excellence of the precepts drawn from the wonders they disclose.

"It is written with a thorough knowledge of the subject, and with that delightful freshness of impression from natural sights which revives the days of our childhood. Here, then, is a beautiful and appropriate present for the Christian parent."—*The Presbyterian.*

"This work deserves high praise. It displays much tact and ingenuity, guided by sound judgment, and controlled by fervent piety. Such books for the young are scarce, and likely to be so; for few are able to produce them. Children will delight in it, and profit by it."—*The Churchman.*

"We look upon this as one among the best juvenile works we have met with."—*Baptist Repository.*